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September 1983 £1

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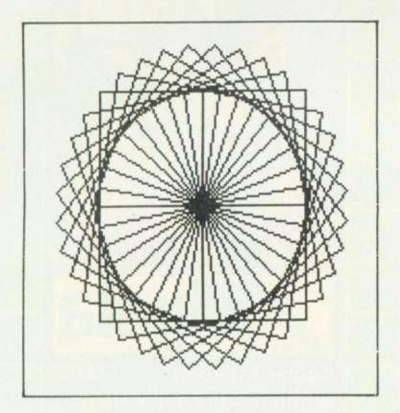
SEPTEMBER 1983
NUMBER FOURTEEN



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Authors please note
We've been inundated with articles for publication – many of an extremely high standard. It takes time to read them, try listings out and edit them – which is the only way to maintain standards. Also please remember that magazines work at least two months in advance.

So please bear with us if you hear nothing for weeks (although all submissions are acknowledged).

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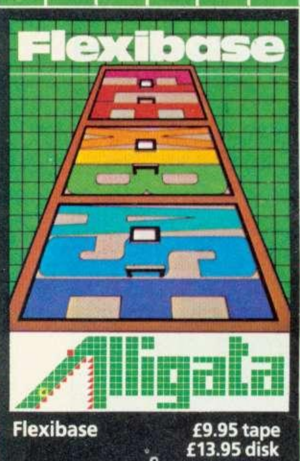
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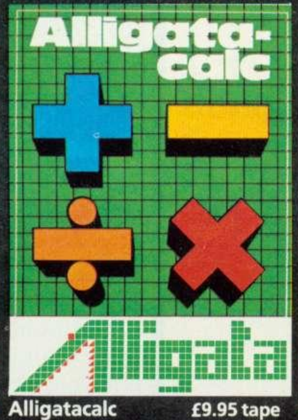
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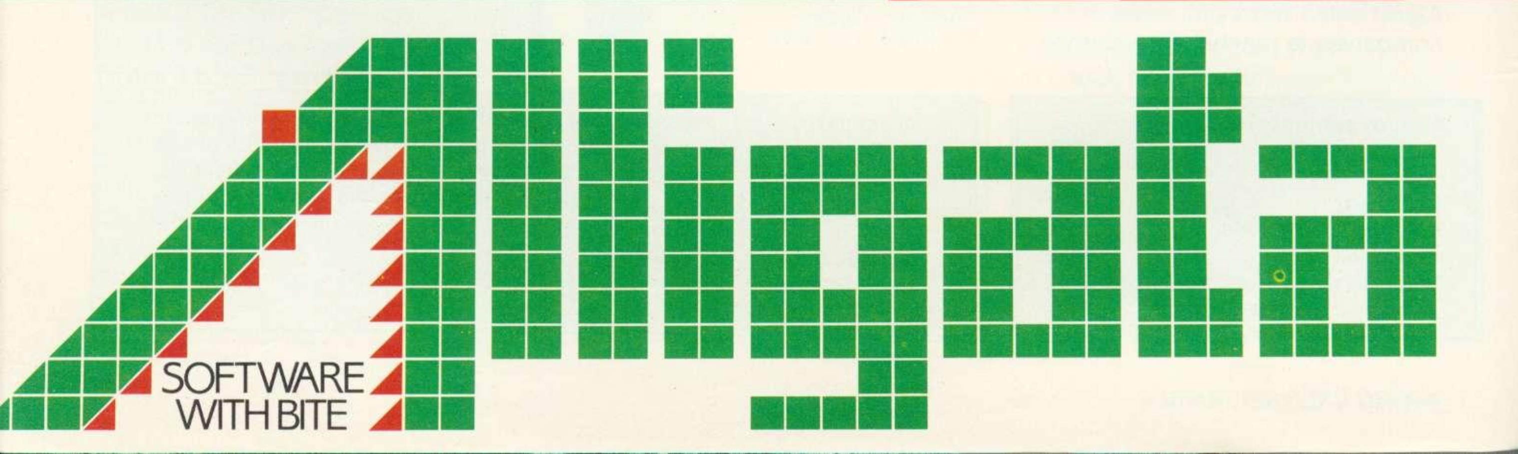
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Pascal subset

A PASCAL subset is available in a 16k ROM at £59 (+ VAT). It supports 32 keywords, 15 operators, a 32-line editor and comments. Pascal T is the name, from HCCS in Gateshead.

The company also produced Logo-Forth for the same price and *Xcal*, a computer-assisted learning package (£65 + VAT).

School graphics

CHEMICAL apparatus with text and labels can be produced on a Beeb for a lesson, rather than on a blackboard, says Hexagon Software.

Chemistry Graphics is the program, which sits alongside *Physics Graphics*. Both will produce diagrams in advance to be saved on tape.

Designer is an introduction to design, and costs the same as the other two packs, £8.90.

Contact Hexagon at 17 Straits Rd, Gornal, Dudley, W. Midlands DY3 2UR.

Printer figures

FIGURES 1, 2, 5, 6 in the article 'Printers for beginners' in the March issue were based on *Computer Peripherals* by D.H. Horrocks and A.B. Wilkinson. We would like to acknowledge the authors, and publishers Hodder & Stoughton for permission to use the illustrations.

Sutton's fair

SUTTON Library in Surrey is to hold its second computer fair. The Library is in St Nicholas Way, Sutton, Surrey, and the dates are Friday 16, and Saturday 17 of September.

April a sell-out

READERS please note that the April issue of *Acorn User* has now sold out. This is the third issue to do so – July/August 1982 and February being the first two.

However, we do offer a photocopy service for specific articles on the Reader Services page.

No pressure on pirates

SOFTWARE pirates look safe to carry on copying for at least another 18 months. Whitehall's attempts to update Britain's out-moded copyright laws stand no chance of getting to the statutes books before 1985.

There are two main reasons. The first is that the whole field of copyright is horrendously complex. But the second appears to be there is little political pressure for hurrying through legislation.

This is because the orthodox areas of copyright protection, though needing some amendments, are still pretty well served by existing regulations.

Just how much illegal copying goes on, and how organised it is, is difficult to estimate. Acornsoft reckon only one in 20 copies of *Snapper* in Cambridge was actually bought. And Computer Concept's *Wordwise* ROM was copied by a company operating from an accommodation address which disappeared overnight.

Sizeable question marks hover over the extent to which the current 1956 copyright laws cover software as the industry was only in its infancy when the act was brought in.

Though gaps in the legislation obviously concern the industry – and particularly programmers – it is not an issue greatly exciting either politicians or the public.

This is in marked contrast to the dramatic speed with which measures were hustled through parliament earlier this year to combat video pirates – and the rumpus which accompanied the visit by George Lucas to Britain. Rewards were put out to recover a stolen copy of his film *Return of the Jedi*.

Then, with millions of pounds and dollars of film-makers' money at stake, former MP Sir John Eden had little trouble in persuading ministers that proper protection was needed.

Unfortunately for software programmers, there is no such political muscle at hand, and no attention fell their way from the papers.



Princess Leia and Luke Skywalker saved by Tory MP

Better software protection from OS

THE latest games from Acornsoft make use of a software protection feature built-into the BBC micro's operating system.

Certain loading errors or attempts to break into the programs result in a 'Blocked' error message. Breaking into the games at a deeper level results in a 'This is a protected program' – type message.

Details of how the system works are not being released by Acorn or Acornsoft (surprise, surprise). However, games from *Starship Command* onwards apparently make use of it.

The first ROM cartridge looks likely to be *Snapper*, and it will be 'dongled'. A 'dongle' is a hardware trick to prevent copying, and in this case means the game cannot be played without the cartidge in place.

Gemini ROMs

GEMINI Marketing are to release ROM-based software. The first program, a Database and Report Generator, will support random access disc files.

Voice synthesis

TWO pieces of hardware are on the market to provide speech facilities for the BBC micro.

The first, at £40, is Smartmouth from Technomatic and is a speech synthesiser. It sits alongside the micro and has a built-in speaker.

Next is Voxbox, a device which digitises speech input for storage on disc. Voxbox, software, microphone and speaker cost £100 from Multiplex Computer Services in Brighton.

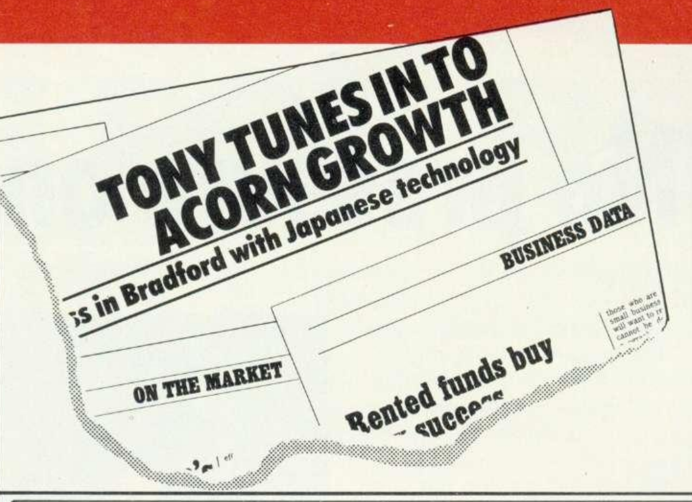
Musical duo

TIME is a group set up to develop the use of technology in musical education.

Acorn User author Joe Telford and MEP co-ordinator Alan Smith have taken charge of the group, which was set up as a result of a recent conference in Southampton.

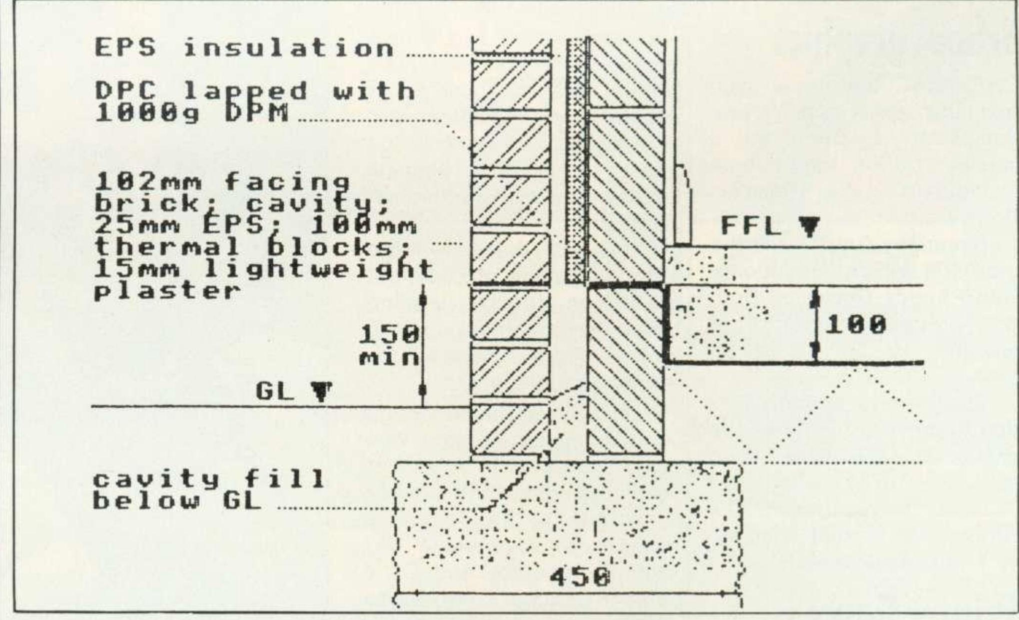
40/80 solution

THE listing in 'The 40/80 disc solution' from August's *Acorn User* (page 39) has lost line 610. This should read: 610 =X%?T%



Cutting line

THIS cutting was passed to us taken from a circular promoting a new magazine, *Your Business*. The combination of our Editor's name with this headline seemed too much of a coincidence. But, he declares, it is just a coincidence – and anyway he comes from Liverpool.



'Serious' software for draughtsmen

DIGITAL Drawings is claimed by its designer Elvin Ibbotson to be the only serious computer-aided draughting system running on the Beeb. And a perspective generator is underway.

It uses mode 4 to provide two colours from a palette of 8 and has been developed to dump scale drawings onto an Epson FX80.

Up to 32 symbols can be predefined, and there are 19 types of hatching available.

Co-ordinates can be handled in three ways – as absolute, X-Y, or relative.

Shapes can be manipulated on the screen or repeated, while text can be added at any point. The package, with manual, costs just under £100 on a 16k EPROM.

Write to Ibbotsons Design Software, The Byre, Ecclesbourne Lane, Idridgehay, Derbyshire DE4 4JB for more facts.

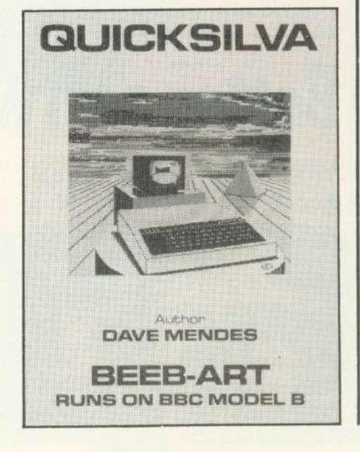
Quicksilva graphics give 'abstract' art

BEEB-ART produces pretty pictures on a model B in mode 2. It's a graphics package from Quicksilva which retails at £14.95.

A total of 34 keys are used, 11 of which are for changing colour, and the others allow for predefined shapes, painting, saving pictures, circles and two drawing styles – 'true' and 'abstract'.

Three example pictures are provided on the cassette: Boats, BBC and Lady. The second is a copy of the arty Beeb micro advert and is used on the booklet which accompanies the cassette. (Apparently, Lady features a candle which flickers on the screen!)

Quicksilva have also announced that CBS Records will distribute the software to the major retail chains with Zap!UK (that's right) handling orders from computer dealers.



Slanging match

IT IS whispered on the grapevine that Acorn has been approached by persons unknown with a request to develop W-Basic – a Welsh language version. Whatever next? A software prize for the person sending in the most ingenious keywords in CRS-Basic (Cockney Rhyming Slang Basic).



Atom scratchpad

A SCRATCHPAD RAM for the Atom has been released by Clare Computer Components.

For £12 (+ VAT) it adds an extra 2k to the machine's memory map, from #9800 to #9FFF. This area is outside the graphics buffers and should not be corrupted by the operating system.

Clare makes a stackable component system for the Atom. Details from 46 Bath Rd, Stroud, Glos, GL5 3JL.

Tough line on bogus chips

ACORN plans to get tough with dealers who are copying the BBC micro's DFS chip.

A company spokesman explained that there are two sources of illicit chips. The first is dealers who have copied development versions of the DFS (ie versions other than 0.90).

The second is dealers or companies who have simply copied and reworked Acorn's coding. The company claims one EPROM being sold consists of large chunks of copied code moved up in memory.

In cases like this, Acorn would put pressure on the party concerned, but is prepared to take legal action.

Acorn's advice to readers who end up with bogus chips is to approach the dealer who did the upgrade and ask for a swap. Otherwise write to Acorn in Cambridge.

IEE standard interface box

AN IEEE488 interface box is being prepared as part of the BBC micro system. Production is set for September and it should be available by the end of the year.

The device will be packaged in the same style as other peripherals for the micro and will have a built-in power supply. A price has yet to be fixed.

Andy Ray of Intelligent Interfaces who developed in the interface with Acorn, explained that it is a full implementation of the standard. It uses the eight addresses on the 1MHz bus reserved for IEEE (FC20-28).

An 8k EPROM provides software for the system. This sits in a sideways ROM and acts as a filing system, so it can be used with any language (called by *IEEE).

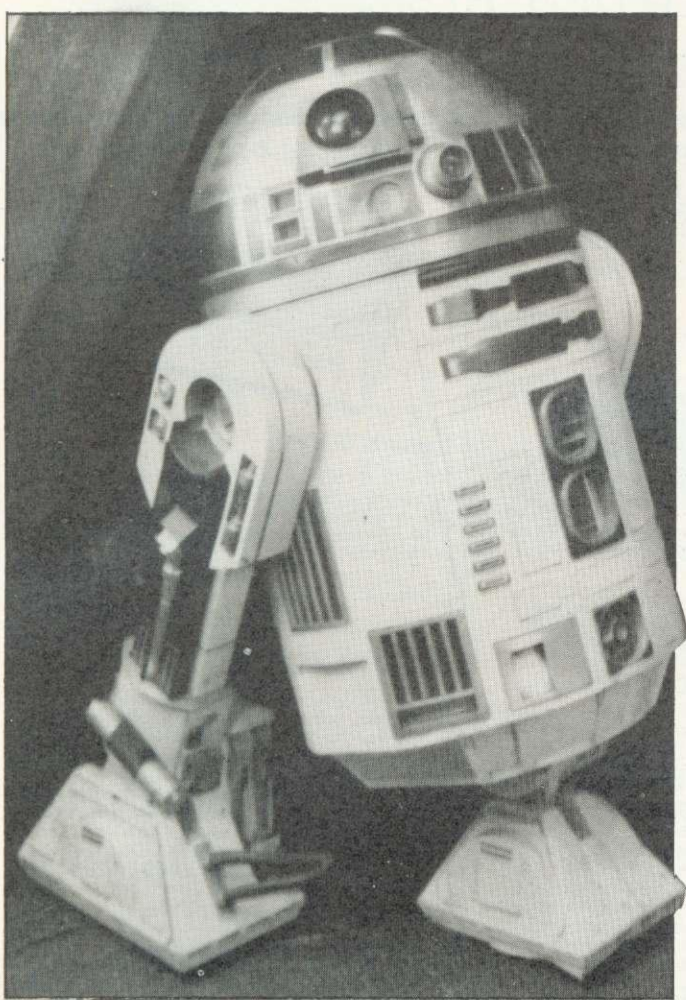
Beeb languages released

AT LAST! Books on Forth, Lisp and BCPL – not to mention the software – are available from Acornsoft. Forth and Lisp cost £16.95 on cassette or £19.90 on disc. The guides on each cost £7.50.

BCPL comes in ROM and is a mite dearer at £99.95, although this includes a utilities disc and book (which costs £15.50 separately). See April's *Acorn User* for a rundown on BCPL.






R2D2-lookalike Kenny Baker set to play Arg Aspidistra

Beebs, Aspidistra and others star in TV show

KENNY BAKER – the man underneath R2D2, goofy TV front-man Chris Searle, dizzy Sandra Dickinson and DJ Noel 'Swopshop' Edmonds are all to co-star alongside Beeb micros in *Adventure Game*.

A new series of the TV programme begins this autumn and features a glorified 3D maze running on a BBC micro which these guest stars, among others, have to negotiate.

The idea is that two earth-people in each episode crashland on the planet Arg which is ruled by Rangdo (Kenny Baker as an Aspidistra!). Their job is then to escape.

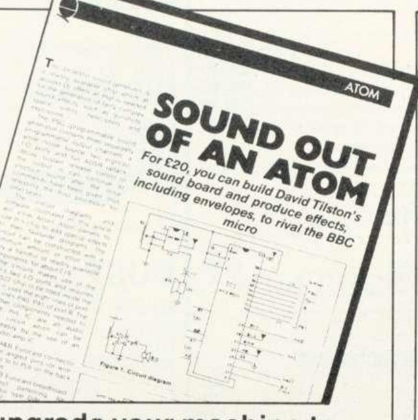
In the process they try their hand at a Lunar Lander game on the Beeb, the 3D maze, and battle with the 'Vortex', amongst other things.

Ian Oliver, producer of the six shows, explained that the opening credits were also produced on Beeb micros, and that they feature snippets from Acornsoft games. Screen shots of *Snapper*, *Monsters* and *Hopper* have been doctored to include people running around.

Arg, the planet, is inhabited by an advanced race of dragons (Argons says the script) and a future spin-off to the TV series is *Drogna* – an adventure game written by Patrick Dowling.

In his pseudo-history of *Drogna*, Patrick Dowling reveals how the adventure fits in: '. . . the Argons insisted on subjecting their visitors to a series of childish tests and problems, among them this game of Drogna which we usually lost, mainly because the chief dragon kept changing the rules!'

PCB for Atom sound generator


ATOM

SOUND OUT OF AN ATOM

For £20, you can build David Tilston's sound board and produce effects, including envelopes, to rival the BBC micro

ATOM users – upgrade your machine to produce sound effects that will rival those of the BBC micro by adding a sound generator. The May issue of *Acorn User* explains how to interface a sound board based around the AY38910 programmable sound generator chip.

The printed circuit board to accompany the article costs £5.38 (inclusive) and is available from: Electro Technical Services, 55 Raymond Road, Hellesdon, Norwich NR6 6PN.

Interface box for BBC micro


INTERFACING

Having covered 1 MHz bus theory, Paul Beverley gets down to practice

INTERFACE BOX FOR THE BEEB

INTERFACE your BBC micro with a specially-designed interface box outlined by Paul Beverley in *Acorn User* (see May's issue for the design and June's for how to test it). For £11.95 we can provide a double-sided printed circuit board with plated through holes, and component overlay.

A kit of parts, as well as fully-built and tested boards is also being made available (should cost about £80 for completed interface box). These prices include UK postage and VAT. Please allow 28 days for delivery.

Make cheques payable to Electro Technical Services at 55 Raymond Road, Hellesdon, Norwich NR6 6PN.

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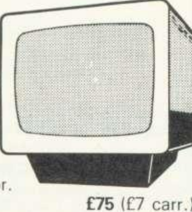
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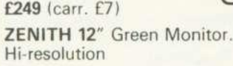
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The Unique Graphic Tablet

Watford Electronics' BEEBPLOTTER will work with 32K BBC Micro. Connects to Analogue port. The unique design makes it accurate and simple to use. Attractively finished. The comprehensive booklet supplied, describes its use in details and shows some of the possible applications.

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EPROM PROGRAMMER for BBC MICRO

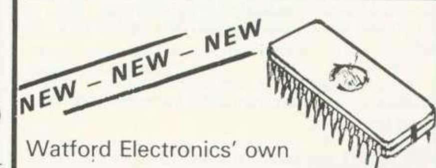
At last! - the EPROM Programmer for BBC Micro computer from WATFORD ELECTRONICS that will suit both your pocket and all your requirements. Programs all popular types of EPROMS from 2K bytes up to 16K bytes - **2764–2516–2532–2564–2764–27128.**
This extremely powerful system is designed for your needs of TODAY & TOMORROW! - BBC Basic programs can be copied into EPROM and subsequently re-loaded faster than from a disc! Suitable for both hobbyist and professional users!

Just look at these features:

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Price: £22

LOGO in ROM

This popular language now available in ROM. Manual included with the ROM.
PRICE: £36.00

WATFORD ELECTRONICS

Continued ⟶

✱ NEW ✱

BBC MICRO DFS

by

Watford Electronics

This powerful new DFS is fully compatible with ACORN DFS yet has much increased power due to additions, carefully designed to make life easier in normal use. It consists of over 14K of efficiently written machine code. It is entirely self contained and so does not require a utilities disc to function.

* The system can either use the ACORN standard 31 files per disc side or DOUBLE THE CAPACITY to 62 files. The size is selected at formatting time. Copying between discs with different catalogue sizes works perfectly normally.

* A FORMATTING PROGRAM is built in, permitting formatting to 35, 40, 80 track formats with either 31 or 62 files.
Since the formatter is built in to the DFS it can be used without affecting whatever program you are using.

* A DISC VARIFIER is also built in. This checks the internal checksums on each sector to identify any corrupted data. This is extremely useful when saving valuable data as it shows faulty discs quickly and easily. Again it does not affect the program you are using.

* A built in **DISC SECTOR EDITOR** gives a screen window onto the disc enabling detailed editing of any byte on the disc. This is very useful for recovering accidentally deleted files and can save weeks of work.

* A double step mode allows the user of 80 TRACK DRIVES TO READ 40 TRACK DISCS. This mode is software selected for each drive individually, thus allowing a 40 track disc to be copied onto an 80 track one very easily. **THIS ELIMINATES THE NEED FOR EXPENSIVE SWITCHABLE DRIVES.**

* A WORKFILE function sets the name to be used when the null filename is issued. This allows a program to be edited and repeatedly saved having only typed its name once.

* When using LOAD, CHAIN, etc. it is possible to specify an ambiguous filename. This will result in the first file whose name matches the specification being used. This saves typing the end of a filename that you know is uniquely identified by its first few characters.

* Two commands exist to simplify the transfer of programs from TAPE TO DISC. These load the file to &1200, switch off the disc system and then move the file to its correct load address; thus saving a lot of complicated programming. This command can be used to load files up to 27K5 long.

* An advanced COPY command is included which will prompt the user, requesting whether to copy each file.

* RENAME has been extended to allow the use of ambiguous filenames. This allows you to change BERT1, BERT2, BERT3 to FRED1, FRED2, FRED3 with only one command.

* OPENOUT has been improved to give you fewer annoying 'Can't extend' errors, as it automatically picks the biggest space on the disc in which to put a file. A SPACE command lets you know how much space *COMPACT could create before you waste time doing it.

* 1.75 K of RAM can be taken over from the DFS for your large BASIC progams while still retaining LOAD, SAVE and *CAT and other simple commands.

* Comprehensive and clearly written Manual (available separately) gives the user a complete package deal.

Price: **DFS ROM** only: **£42**

Complete interface **KIT** incl. DFS ROM **£85**

Comprehensive and clearly written manual £7.50

P.S.
We will exchange your existing ACORN DFS for the highly superior Watford's DFS ROM for **£35**.



FORTH ROM for BBC

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LOGO in ROM

This popular language now available in ROM. Manual included with the ROM.

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Adds following facilities to FORTH. 6502 Assembler, providing machine-code within FORTH - Turtle graphics enables easy to use colour graphics - Decompiler routines enables versatile examination of your compiled FORTH programs - Full double number set - An example FORTH program and graphics demostration - Other useful routines - 64 page manual ONLY **£10**

LOGO II

This language is very popuar in American schools as it is an ideal educational program. It can graphically demonstrate the ideas of defined procedures, sub-routines, loops and even recursive programming. Gives excellent introduction to LOGO language for young and old alike.

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DISASSEMBLER

Will generate fully labelled assembly listings of any machine code program. Data is automatically differentiated from code and displayed together with its ASCII equivalent. Assembly listing can be saved in *EXEC format and subsequently incorporated into user programs. In our opinion this is an excellent software at an incredibly low price.

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EMULATOR

An extremely powerful and flexible machine code interpreter. Allows you write and debug machine code as easily as BASIC. Features single step, breakpoint register display, edit modes, etc.

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FILER

A powerful file handling program. Filer allows the user to build up, manipulate, store and retrieve data. A very powerful package indeed.

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Computer Concept's Firmware

BEEB-CALC £34

A ROM based spreadsheet program, like wordwise this firmware is fast and simple to use - yet is a powerful spreadsheet analysis program, considerably better than the original 'calc' program - full floating point maths. Works in 40 or 80 column screen modes - variable column widths. Works with either cassette or disc. This ROM coupled with Wordwise can turn your micro into an ideal small business machine.

DISC DOCTOR £22

This ROM contains useful disc utility programs. Enables recovery of any data off the disc including deleted files etc. The full disc editor allows the alteration of any bytes directly on the disc (or in memory), or the loading and saving of any track or sector on the disc. Automatic transfer of programs from tape to disc and vice versa. Also includes a whole host of other useful utilities - string search, function key editing, the ability to format 35, 40 & 80 track discs.

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N.B. All the above Gemini software is on tape. For Disk Based (40/80 track) please add £3.

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BBC DFS MANUAL

A fully comprehensive disc manual for BBC Micros. All extra commands are included. A bargain at

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BBC MICRO ROM PAGING SYSTEM
Explained

A comprehensive explanation of the requirements for Sideways ROMs to be used in the BBC Micro. Language and Service entries are explained with their call numbers. This book contains all the information that we have discovered in writing our 16K BBC DFS.
A must for all serious users of BBC Micro.

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Do you know WHERE? you are? This well written program, using high resolution graphics offers timed tests on the geography of Great Britain.

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Beautifully drawn Hi-Res colour map of the world illustrates and aids this graded series of tests on capital cities and populations of the world

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(Age 7-13). Provides an opportunity for children to teach the computer to differentiate between objects. The program tries to guess the object the child has thought of, using personalised responses like Mmm . . . I am thinking.

BRITISH GEOGRAPHY **£6.95**
Teaches a child the locations of Cities and Ports using directional keys.

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Aimed at junior school age. Sequences of colours and sounds teaches a child to concentrate.

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(Age 4-6). No reading skills are required to use this colour graphics number recognition and counting program. Children build patterns of flowers corresponding to figures, quickly learning their significance.

INTRO TO ARITHMETIC **£10.45**
4 programs - Additions, subtractions, multiplications and divisions. Help stage, moving graphics and colours. Worksheet produced at the end of program. (5-7 years old).

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Full screen demonstration of correct formation of lower case alphabetic characters. Several choice of sequence (5-7 years).

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Highly acclaimed at the BBC Micro User Exhibition.

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GEOGRAPHY-ITALY	£5.50

(for Disc based software please add £2.75 to the above prices).
These separate packages teach basic geography of each country - seas, rivers, towns and mountains. There are tests on these which allow for some spelling errors. Praise is given for good results. It utilises BBC's Colour, Graphics and Sound facilities. The Italy package consists of two programs.

MATHS - TRANSLATIONS (Age 9-19yrs)
This package explains how to translate Triangles and Quadrilaterals, moving these geometrical shapes on a grid. It goes step by step through the concepts and the matrix calculations involved. Excellent software. **£5.50**

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DWARFS AND TROLLS

by Simon Dally
Your chance to win a Seikosha printer worth £200

IN THE basement of the *Acorn User* offices in Bedford Square is a vast dungeon inhabited by dwarfs and trolls. Three Seikosha printers, generously donated by Microage Electronics, await discovery there.

Neither dwarfs nor trolls are very malicious creatures. Indeed, they seek to assist at all times. From an adventurer's point of view, however, there is a communications problem. For it is a fact that dwarfs always tell the truth and trolls lie.

In addition, a few of the characters are invested with magical powers – and even a troll doesn't lie when imparting magical formulae. However, unless you know a troll is a magician (and he'll naturally tell you that he isn't one) he always lies about his mathematics. So if a troll tells you to multiply something you should divide and if he tells you to add you should subtract – and *vice versa*. No room ever contains more than one magician.

To the inhabitants of the dungeon all this is of no consequence. A troll can understand what a dwarf is saying because he always tells the truth. Similarly, a dwarf knows that the truth is the opposite of what any troll declares.

Unfortunately the human eye cannot distinguish between dwarfs and trolls and can only rely upon the logic of the brain – or a personal computer – to ascertain truth. A close acquaintance with logical operators and truth tables will assist the inexperienced adventurer (July 1983 issue).

The first of the three printers is located inside a tardis abandoned by an Acorn programmer on his way home for Hogmanay (it broke down and he had to get a taxi!) But to get into the machine you have to know the right combination; to obtain it you will have to modify your number by observing the rules:

1. Do what each character tells you in the same order in which you are spoken to.
2. If a troll gives you instructions do the opposite of what he says.
3. If a magician is present do only what he tells you and ignore any other instructions from a character in that room.

If at any time the number you are working on becomes a decimal number you must make it into an integer following the rules of the Basic INT(x) statement – ie all decimals are rounded down so you always carry with you a number which is a positive integer.

First you are given a *Puzzlers' Guide* containing four puzzles:

Puzzle No. 1

Dungeon money has not yet gone decimal – it uses the old pounds, shillings and pence system which consisted of 12 pennies to the shilling and 20 shillings to the pound. Therefore 240 pennies equal one pound.

Now, £66 6s 6d is 15,918 pennies. If you add the digits in 15,918 you get 24, which by coincidence is also the sum of the four sixes in the sum of money. Using one digit only in similar fashion find another sum in old money where the sum of the digits equals the sum of the digits of its value in pennies.

Puzzle No. 2

An obsessive dwarf gambler visits the dungeon casino and wants to arrange his roulette chips into straight rows of equal length on the table before him so that he can see them all (no chip can lie on top of another).

He tries lining them up in rows of 2, 3, 4, 5, 6 and 7 but always he finds he is one chip short in the final row. Finally he discovers that by tipping the croupier one chip he can exactly arrange the rest into rows of 11.

What is the lowest number of chips he could have started with?

Puzzle No. 3

The sum 14*926 = 12964 – in other words the five digits in the original sum are all different and produce the same digits in the result. What other sum involving positive integers of the order ab*cde can you construct which behaves in the same way?

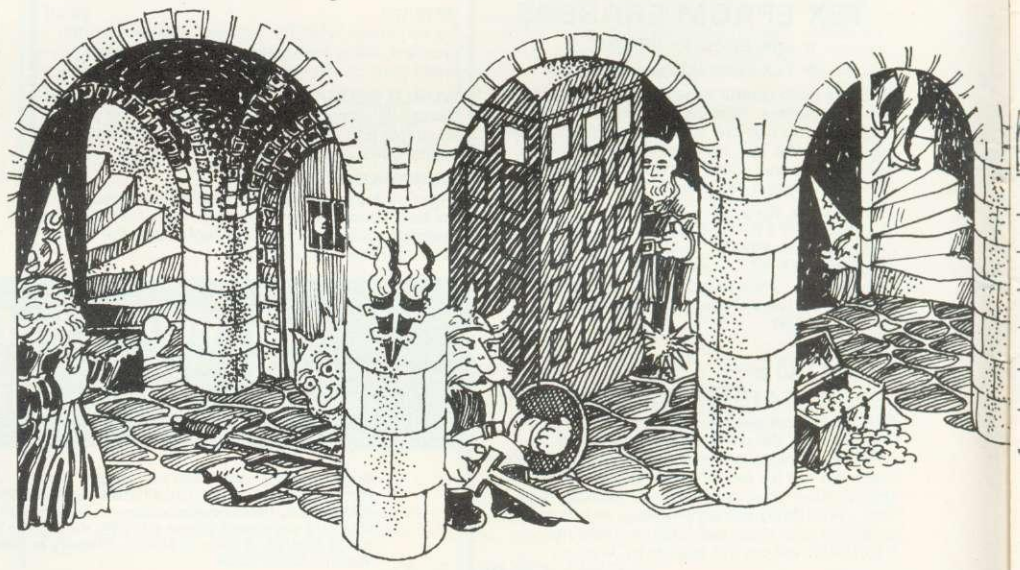
Puzzle No. 4

What is the smallest positive integer ending in 4 which when multiplied by 4 is the same number but with the last digit transposed to become the first?

Armed with this leaflet, you, O foolish mortal, descend past piles of discarded crutches and leg plasters, into the dungeon. You are immediately confronted by two dungeon-dwellers, A and B. A says: 'At least one of us is a troll. You must start with the number which is one half of the answer to puzzle 4.'

B says, 'A is a lying, two-faced troll. You should divide your number by 3.'

Being a logical adventurer, you reason thus: If A is a troll then he



lies. Therefore neither A nor B can be a troll and both are dwarfs. But if A is a dwarf and B is also a dwarf then A's statement would be a lie, which is impossible. Therefore A is not a troll so must be a dwarf and his statement must be correct. Thus B is a liar. Therefore the number to start with is half the result of puzzle 4 multiplied by 3.

Following your astute reasoning, you proceed further into the dungeon with your number. At the end of the passage you are confronted by three characters, A, B and C. A says: 'All of us are trolls. Multiply your number by the sum of the digits of the number of pennies in the answer to puzzle 1.'

B says; 'Exactly one of us is a dwarf. Multiply your number by 3.'

C says: 'Multiply your number by the answer to puzzle 2.'

Of course, you sailed through that and now you find three dungeon-dwellers guarding a Circle of Gold (guaranteed to win you £164,000 for a trifling investment – buy now while stocks last).

A: 'B is a troll.'

B: 'A and C are either both dwarfs or they are both trolls.'

C: 'Add the value of the Circle of Gold to your answer.'

In the next room are two more characters.

A: 'Puzzle 3 has but one answer. Add the five-digit product to your number.'

B: 'Puzzle 3 has 11 solutions of which A has found merely the lowest result obtained by multiplying *ab* by *cde*. Add all of the results of the multiplication sums to your number.'

With your new number you proceed to the magical level of the dungeon. Three creatures confront you.

A: 'I am the magician. Multiply your number by five.'

B: 'I am the magician. Divide your number by four.'

C: 'I am the magician. At most, only one of us is a dwarf. Divide your number by three.'

Two creatures await you in the next room.

A: 'The magician is a dwarf. Add the number of pennies in the answer to puzzle 1 to your number.'

B: 'The magician is a troll. Subtract the number of pennies in the answer to puzzle 1 from your number.'

Finally, you arrive at the tardis garage and find three characters guarding it. This time you know the magician is a dwarf.

A: 'At least one of us is a troll. Add the answer to puzzle 4 to your number.'

B: 'C is the magician. Subtract the answer to puzzle 2 from your number.'

C: 'The combination is the square root of your number.'

Now of course you can open the tardis and get the printer. What is the correct combination? Answers on a postcard please to September competition, Acorn User, 53 Bedford Square, London WC1 to arrive not later than October 3. Please say which machine you have. Next month: more goings-on in the dungeon for the other two printers.

● **May competition:** Two Acornsoft packs are on their way to: J/T Whipp (a high-flier this one); Frank Dashwood (lovely postcard) and Louise Carey who's 11 (just). The answer is that there are 10 valid numbers.





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```
C7=0 15
              23 K
 -------A------B-------C-------D-------E
1|| MONTH    ||     JAN     FEB     MAR
2|| --
3||UNIT £    ||    6 67    3 14   22 45
4||LABOUR    ||      32      43      65
5||PAPER     ||      05      12      43
6||----------------------------------
7||SUB TOT   ||    7 04    3 69   23 53
8|| VAT      ||    1 06      55    3 53
9||TOTAL     ||    8 10    4 24   27 06
```

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*OPT3,n	Alters the number of tracks per disc to n
*OPT5,n	Sets the start address of the DFS buffer (see OPT7)
*OPT6,n	Provides control over which part of the file spec. will be displayed ie. only display directory and program length, or just display drive and load address etc.
*OPT7,n	Sets the length of the DFS buffer
*OPT8,n	Allows 80 track drives to read 40 track diskettes
*SYS	Selects either Acorn mode or Extended mode

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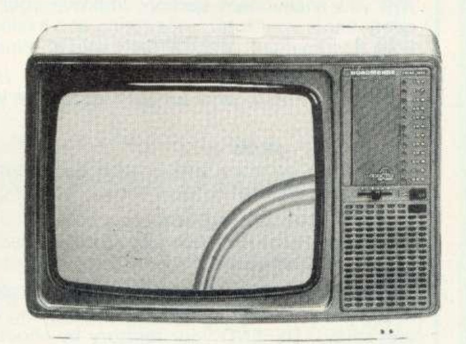
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INK BLOT ON THE LANDSCAPE

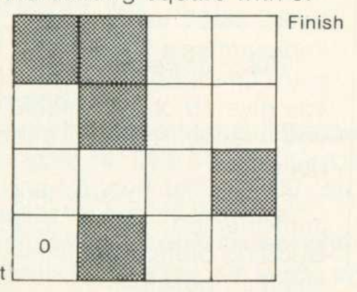
Stan Froco turns his hand to solving a maze using ink-blots – a converse technique to tree-sorting

I HAVE been asked recently whether this series is relevant to the Electron. The answer is that all the programs use BBC Basic, and so will work on any machine which has this. This includes the BBC micro, the Electron and any second processor supporting BBC Basic. The programs are general and can be translated into other languages, often with improved performance. The technique I am about to describe works far better in Lisp, and earlier examples of sorting and hashing were adapted from BCPL programs.

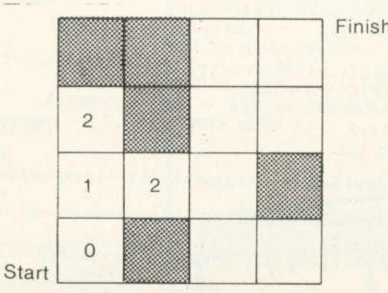
Last month I described tree-sorting. Having constructed the sorted tree, the program printed it out by climbing down the left branch of the tree, and each sub-tree, printing values as it went, and then climbing down the right branch and each sub-tree. In particular, the program went to the bottom of the left branch looking for values, before tackling the right branch. This is an example of a depth-first search.

The converse of this (which is not suitable for tree-sorting) is the breadth-first search, in which we look at the left branch, just down one step, then the right branch down one step, then go back to the left branch and look down two steps, then the right branch two steps and so on until we cover the whole tree. The search spreads out from the root of the tree. It is from this spreading that the more popular name of 'ink-blot techniques' arises.

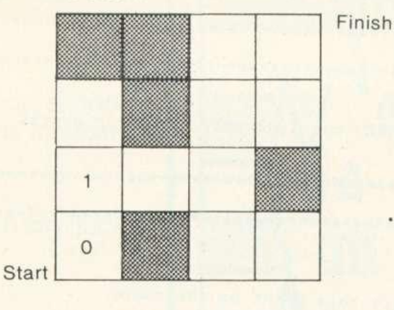
To illustrate the method, consider the problem of finding a way through a small maze. First we mark the starting square with 0:



We can mark all the unblocked squares adjacent to this 1, since they must be at least one step from the start (no diagonal moves allowed).



Now all the squares adjacent to that marked 1 can be marked 2, since they are at least two steps from the start:

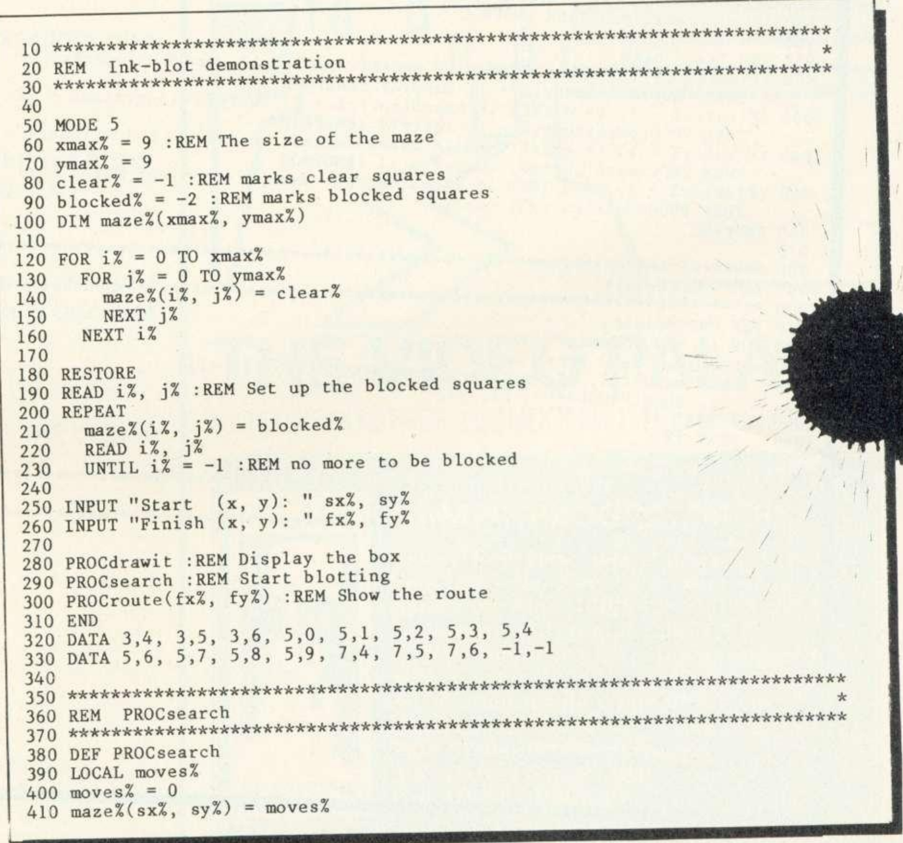


Notice how we are spreading in two directions. Also if a square is already marked we leave it (to avoid repetition).

Thus the bottom left hand square is not changed to 2. After repeating this process several more times we are left with:

		5	6 (Finish)
2		4	5
1	2	3	
0 (Start)		4	5

The value in the finish square tells us how many steps it took to get from the start. We can print out the route (in reverse order) by starting at the finish square. The previous square on the route must be adjacent to this with a value one less. The next previous square will be one less than that, and adjacent



```
10 ***********************************************************************
20 REM  Ink-blot demonstration                                           *
30 ***********************************************************************
40
50 MODE 5
60 xmax% = 9 :REM The size of the maze
70 ymax% = 9
80 clear% = -1 :REM marks clear squares
90 blocked% = -2 :REM marks blocked squares
100 DIM maze%(xmax%, ymax%)
110
120 FOR i% = 0 TO xmax%
130   FOR j% = 0 TO ymax%
140     maze%(i%, j%) = clear%
150     NEXT j%
160   NEXT i%
170
180 RESTORE
190 READ i%, j% :REM Set up the blocked squares
200 REPEAT
210   maze%(i%, j%) = blocked%
220   READ i%, j%
230   UNTIL i% = -1 :REM no more to be blocked
240
250 INPUT "Start  (x, y): " sx%, sy%
260 INPUT "Finish (x, y): " fx%, fy%
270
280 PROCdrawit :REM Display the box
290 PROCsearch :REM Start blotting
300 PROCroute(fx%, fy%) :REM Show the route
310 END
320 DATA 3,4, 3,5, 3,6, 5,0, 5,1, 5,2, 5,3, 5,4
330 DATA 5,6, 5,7, 5,8, 5,9, 7,4, 7,5, 7,6, -1,-1
340
350 ***********************************************************************
360 REM  PROCsearch                                                      *
370 ***********************************************************************
380 DEF PROCsearch
390 LOCAL moves%
400 moves% = 0
410 maze%(sx%, sy%) = moves%
```



```
420
430 REPEAT :REM Spread out one deeper each time
440   moves% = moves% + 1
450   UNTIL FNblot(moves%, sx%, sy%)
460 ENDPROC
470
480 ******************************************************************
490 REM  FNblot
500 ******************************************************************
510 DEF FNblot(depth%, currx%, curry%)
520 LOCAL currmaze% :REM the depth of the cell under consideration
530 currmaze% = maze%(currx%, curry%)
540
550 IF currmaze% = (depth% - 1) THEN =FNmarkadjacent(depth%, currx%, curry%)
560
570 REM Otherwise keep on spreading
580 IF ((currx% + 1) <= xmax%) THEN IF maze%(currx% + 1, curry%) > currmaze%
     THEN IF FNblot(depth%, currx% + 1, curry%) THEN =TRUE
590 IF ((currx% - 1) >= 0) THEN IF maze%(currx% - 1, curry%) > currmaze%
     THEN IF FNblot(depth%, currx% - 1, curry%) THEN =TRUE
600 IF ((curry% + 1) <= ymax%) THEN IF maze%(currx%, curry% + 1) > currmaze%
     THEN IF FNblot(depth%, currx%, curry% + 1) THEN =TRUE
610 IF ((curry% - 1) >= 0) THEN IF maze%(currx%, curry% - 1) > currmaze%
     THEN IF FNblot(depth%, currx%, curry% - 1) THEN =TRUE
620 =FALSE :REM Haven't spread far enough yet
630
640 ************************************************************************
                                                                          *
650 REM  FNmarkadjacent
660 ************************************************************************
670 DEF FNmarkadjacent(depth%, currx%, curry%)
680 IF (currx% + 1) <= xmax% THEN IF FNmarkit(depth%, currx% + 1, curry%)
      THEN =TRUE
690 IF (currx% - 1) >= 0 THEN IF FNmarkit(depth%, currx% - 1, curry%)
      THEN =TRUE
700 IF (curry% + 1) <= ymax% THEN IF FNmarkit(depth%, currx%, curry% + 1)
      THEN =TRUE
710 IF (curry% - 1) >= 0 THEN IF FNmarkit(depth%, currx%, curry% - 1)
      THEN =TRUE
720 =FALSE
730
740 ************************************************************************
                                                                          *
750 REM  FNmarkit
760 ************************************************************************
770
780 DEF FNmarkit(depth%, currx%, curry%)
790 IF maze%(currx%, curry%) = clear% THEN maze%(currx%, curry%) = depth%
800 = (currx% = fx%) AND (curry% = fy%)
810
820 ************************************************************************
                                                                          *
830 REM  PROCroute
840 ************************************************************************
850 DEF PROCroute(currx%, curry%)
860 LOCAL currmaze%
870 currmaze% = maze%(currx%, curry%)
880 PROCbox(1, currx%, curry%) :REM Mark this point on the route
890 IF currmaze% = 0 THEN ENDPROC
900
910 REM Trace back
920 IF(currx% + 1) <= xmax% THEN IF maze%(currx% + 1, curry%) (currmaze% - 1)
      THEN PROCroute(currx% + 1, curry%) :ENDPROC
930 IF(currx% - 1) >= 0 THEN IF maze%(currx% - 1, curry%)=(currmaze% - 1)
      THEN PROCroute(currx% - 1, curry%) :ENDPROC
940 IF(curry% + 1) <= ymax% THEN IF maze%(currx%, curry% + 1)=(currmaze% - 1)
      THEN PROCroute(currx%, curry% + 1) :ENDPROC
950 IF(curry% - 1) >= 0 THEN IF maze%(currx%, curry% - 1)=(currmaze% - 1)
      THEN PROCroute(currx%, curry% - 1)
960 ENDPROC
970
980 ************************************************************************
                                                                          *
990 REM  PROCdrawit
1000 ***********************************************************************
1010 DEF PROCdrawit
1020 FOR i% = 0 TO xmax%
1030   FOR j% = 0 TO ymax%
1040     IF maze%(i%, j%) = clear% THEN PROCbox(3, i%, j%)
           ELSE PROCbox(0, i%, j%)
1050     NEXT j%
1060   NEXT i%
1070 ENDPROC
1080
1090 ***********************************************************************
                                                                          *
1100 REM  PROCbox
1110 ***********************************************************************
1120 DEF PROCbox (col%, i%, j%)
1130 LOCAL xlo%, ylo%, xhi%, yhi%
1140 xlo% = i% * 50 + 350
1150 xhi% = xlo% + 50
1160 ylo% = j% * 50 + 250
1170 yhi% = ylo% + 50
1180 GCOL 0, col%
1190 MOVE xlo%, ylo%
1200 MOVE xhi%, ylo%
1210 PLOT 85, xhi%, yhi%
1220 MOVE xlo%, yhi%
1230 PLOT 85, xlo%, ylo%
1240 ENDPROC
```

to this last square. The process is repeated until the square with 0 is reached. Notice that in this example there are two equally good routes. An arbitrary choice can be made to select one or the other.

Program 1 will find the shortest route for just such a maze, and displays the result. I make no claims as regards its efficiency, because Basic is not ideally suited to the problem and this routine aims for clarity. PROCsearch does the ink-blotting, spreading out one move at a time using FNblot. Most of the inefficiency arises when FNblot works out where to mark with moves%. It traces all the way from the start each time, finding all the squares with moves%-1, and then marks all the adjacent squares. A better method would be to keep a list of squares marked with moves%-1 the previous time, and go straight to them. FNmarkadjacent takes each adjacent square in turn and marks it using FNmarkit, which checks the square isn't blocked or already marked. It returns true if we have reached the finish square, and this result is passed back via FNmarkadjacent and FNblot to tell PROCsearch to stop searching. PROCdrawit and PROCbox are used to display the maze (white for clear, black for blocked). PROCroute displays the complete route in red using PROCbox. The shape of the maze is set up in lines 200 – 230 using data lines 320 and 330. This may be changed to alter the maze.

This program actually contains a bug as it assumes that there is always a route between the start and the finish. This was done to keep the length of the program down and I leave the reader to correct it.

Applications for this technique are widespread. A very valuable one is in laying out printed circuit boards. You start with a completely clear maze, and each time you lay a track between two points you mark it as blocked (a subsequent track may not cross it). Various improvements have to be made: If you cannot connect two points, do you give up or back-track? How do you cope with double-sided boards?

I have yet to see this problem implemented on a BBC micro. Budding professionals might like to see if it's possible.

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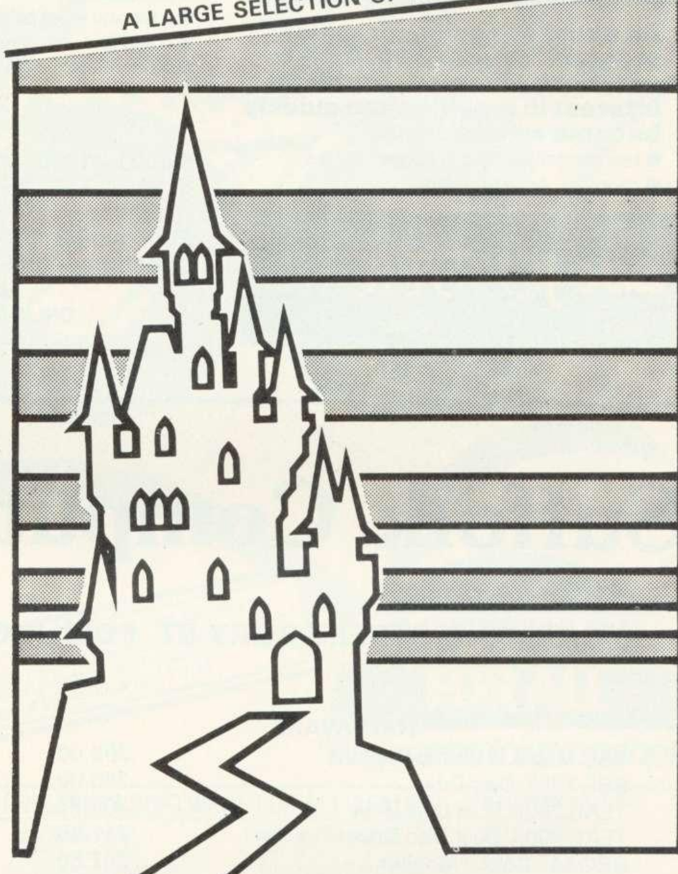
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SPEED-THE BIG DIFFERENCE

Paul Beverley finds the Electron is a lot slower than the BBC micro-but has some ideas on the problem

Benchmarks on the Electron show up one of its major differences compared with the BBC micro – the timings vary between graphics modes. Table 1 shows that the time taken to execute the benchmarks is considerably greater in one of the higher resolution graphics modes. In the same table are the results of a machine code benchmark which is simply a set of nested delay loops. As you can see, in the worst case, the Electron takes 4.3 times as long to run the same program as the BBC micro.

The differences in speed between the two computers are accounted for by various factors. First, although the 6502A processor is capable of running at 2MHz, it is only working at full speed when accessing ROM. As soon as it accesses the RAM, it effectively slows down to 1MHz. The reason for this is that the read/write memory is arranged in four 64k by 1 bit chips, each of which therefore contains two bits of information for each byte.

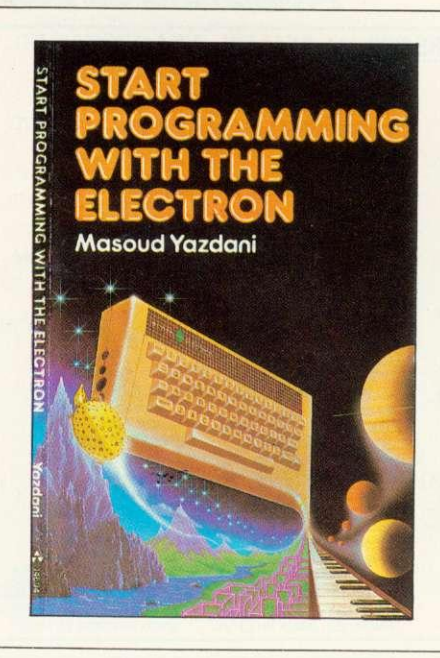
Therefore, to get the full eight bits, you have to take two sets of bits from RAM, which means two accesses for each read or write operation. This 1MHz RAM access is confirmed by the timing of the machine code program in modes 4, 5 and 6 which is exactly twice that of the BBC micro. The difference in speed in the other modes is affected by the constraints of generating the high resolution video display.

To get video information out of RAM and turn it into colour information for the colour monitor, you need to be continuously accessing the information which is in RAM and serialising it. That is, the information in each byte has to be sent out to the VDU as a series of dots which appear on the screen as the cathode ray tube beam scans across it. The rate at which this information needs to be sent out to the screen depends on the density of these dots.

Let us consider mode 0 which, being a two-colour mode, is the simplest to understand. Since it only needs one bit of memory to represent each screen dot, and since there are 640 dots per line, 640 bits of information have to be sent out during each line scan which takes 40 microseconds. Now, 640 bits is 80 bytes of information, which means you have to get information out at the rate of 80/40 bytes per microsecond, or 2MHz.

In modes 1 and 2, although there is a smaller number of dots across the screen, the information still has to be accessed from RAM at the same rate since each dot is represented by a larger number of bits to give the colour information. In mode 3, there are blank lines inbetween the rows of characters which contain no video information and therefore the situation is not quite so bad as in the higher modes. In modes 4, 5 and 6, with half the number of dots across the screen, the speed of access which the video processor in the ULA has to make to RAM is only 1MHz and so the processing speed is not affected.

How then, does the Electron cope with putting out information at 2MHz? In the lower graphics modes, the RAM access of the video processing section of the ULA is interleaved with the access by the 6502A processor. In other words, during one phase of the system clock cycle the 6502A accesses the RAM, and during the other half cycle, the video processor does its accessing. However, because of the higher



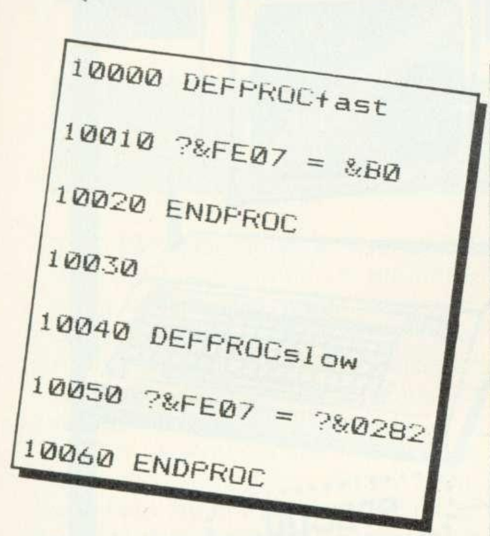
THE Electron comes complete with two books – a user guide and a programming guide. The two books are designed to complement each other, the second being an easy introduction which makes extensive reference to the first.

The programming book starts off with a simple introduction to the Electron and goes on to cover sound, graphics, arithmetic, problem solving, games and most of the techniques needed to write programs.

It's style is chatty, illustrated with cartons, and is most definitely on the side of structured programming – not a single GOTO in sight! Procedures and functions abound with long variable names, and all listing have been dumped using LISTO7 on a daisy wheel.

Four listings take up the final 21 pages of the book's 138 pages. These are turtle graphics program, which links up with a maze solver, a greeting program, and River-game – the old chicken, fox, grain problem.

The publishers, Addison-Wesley, are to release the book to the general public at £6.95. The author Masoud Yazdani, also appears to have several follow-up books in store which will no doubt transfer onto the BBC machine.



```
10000 DEFPROCfast
10010 ?&FE07 = &B0
10020 ENDPROC
10030
10040 DEFPROCslow
10050 ?&FE07 = ?&0282
10060 ENDPROC
```

Figure 1. Two simple procedures for switching speeds by putting the display into mode 6 without clearing RAM, and then restoring the mode as recognised by the MOS

Test	BBC	Electron				
	Any mode	Mode0	Mode1	Mode2	Mode3	Modes 4,5,6
BM1	0.6	1.8	1.8	1.8	1.4	0.8
BM2	2.7	7.6	7.6	7.7	6.2	3.7
BM3	7.8	22.2	22.3	22.5	18.1	10.8
BM4	8.4	23.8	23.9	24.1	19.2	11.4
BM5	8.8	24.9	25.0	25.2	20.1	11.9
BM6	13.2	37.7	37.8	38.2	30.5	18.1
BM7	20.7	57.9	58.1	58.7	47.1	28.0
BM8	5.0	14.9	14.9	15.1	12.0	7.1
BM7+8	25.7	72.8	73.0	73.8	69.1	35.1
Factor		x2.83	x2.84	x2.87	x2.69	x1.37
MC loop	27.5	118.0	118.2	119.5	94.3	55.0
Factor		x4.29	x4.30	x4.35	x3.42	x2.00

Table 1. PCW benchmarks and machine code loop timings in different graphics modes compared with the BBC timings. (Timings for modes 4, 5 and 6 are virtually identical.)

speed needed, in modes 0 to 3 the ULA has to take over the RAM entirely during the active portion of the line scan – that is for 40µs out of every 64. The result is that for 40µs the processor is stalled and does no processing.

This has an implication for interfacing. Although there are address, data and control lines available on the external edge connector, it is in Acorn's own words, 'a non-trivial interfacing problem'. The reason is that the clock signal available on the edge connector will sometimes be 2MHz, sometimes 1MHz, and sometimes totally stalled for 40ms.

You will notice from the benchmark timings, that mode 3 is not as bad as modes 0, 1 and 2. The reason for this is that the processor can, in fact continue processing during the inactive lines between the rows of characters. To explain this a little further, if you change to mode 3, and execute a VDU 19,0,4,0,0,0 to change the background colour to blue, you will see the screen appears as a set of blue lines on a black background. If you type in some characters, you will see that they only appear in the blue lines and not in the interleaving black areas. Therefore, while the dot is scanning these black lines, there is no information being taken from RAM, and therefore the processor can continue processing.

This is all very interesting to the technically minded, but how does it help if you want to improve the speed of a program run on the Electron? If you have a program which uses the higher modes of graphics but which has a large amount of calculation to be done, there is a simple method of improving its speed. It is shown in figure 1 as two procedures, one which switches to a fast mode of processing and the other which returns you to a slow mode of processing. To achieve this fast mode, what you do is to switch the ULA into mode 6 by pokeing a number into one of its registers. (Yes, I know, I'm a complete hypocrite after all I've said about using the OSBYTE calls! But then, there are no calls to do this as far as I am aware.) The effect of this poke is to produce a rather strange effect on the screen since the information in RAM is arranged for whichever of the higher modes of graphics you are using, whilst the upper 8k of that information is being displayed by the ULA as if it were in mode 6. However, this means the processing speed is the maximum of which the computer is capable, and although the display is distorted, it is simply a matter of using PROCslow to switch back to the original mode of graphics which will restore the display to normal. The register in the ULA used to set the mode of graphics (&FE07) is a write-only register, so the operating system has to keep a copy of what it has put in there for testing by various OSBYTE routines. This is kept in memory location &0282, and therefore PROCslow simply takes the contents of that location and puts it into &FE07.

If you want to do any drawing on the screen, and yet still want to work in the fast processing mode, there is no problem. What happens when you do the drawing is that the operating system looks at &0282 to find out which mode of graphics it is in and then changes the contents of RAM for the appropriate draw or plot. Therefore the drawing or plotting continues normally, even though it produces a rather strange effect on the screen display which is apparently mode 6, but as soon as you execute PROCslow, the display returns with all the lines you drew displayed normally. To give an idea of how much this speeds things up, the *Persian* program given in the BBC and Electron manuals takes 34.1s to run on the BBC whereas it takes 105.1s on the Electron (3.1 times as long). However, if you add the PROCfast and PROCslow commands it reduces the time to 50.8s.

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MEET THE WELCOME TAPE

THE Welcome tape which comes with the Electron has 15 programs on it as follows: Intro; Keyboard; Sketch; Piano; Dodgems; Biorhythms; Clock; Gomoku; Message; Patterns; Marslander; Bugzap; Island; Planets; and Bye.

One general comment is that the tape is presented in a slightly better way than the one for the BBC micro in that it is recorded on two sides of the cassette. When you get to the program 'message' it prompts you to turn the cassette over straight away and carry on. Thus by the time you have finished the last program you are almost back to the beginning of the tape and don't have to spend ages re-winding – a simple thing, but it shows someone has thought about presentation.

Intro is remarkably similar to the first one on the BBC Welcome tape. It presents the Electron Logo and then gives a list of programs on the cassette. Then, before going onto the next program, it asks you to set the time for the clock.

Keyboard is an essential program to run, even if you are familiar with the BBC keyboard. There are various ways in which the Electron keyboard is different, and therefore it is helpful to try out this program.

Sketch is somewhat more advanced than the version for the BBC micro in that it allows you not only to draw and move using the cursor keys, select the colour and clear the screen, but also to use the colour fill available in the operating system. A nice piece of software if rather slow.

Piano is a very neat little program which demonstrates the computer's sound and shows on the screen the notes being played on the keyboard. The graphics are of a very high quality and can even draw the treble clef. By using the keys 'Z' to ':' you have one and a half octaves on the keyboard, but by using the up and down cursor keys you can raise and lower the pitch over seven octaves. However, at high frequency it goes supersonic half way through the top octave!

Dodgems comes straight off the Acornsoft *Arcade Action* cassette for the BBC micro and works well on the Electron. Your own car and a car controlled by the computer are travelling in opposite directions around a set of square tracks, and you have to eat as many dots as possible before being crashed into by the computer's car.

Biorhythms is straight from the BBC Welcome cassette.

Clock again comes from the BBC cassette and draws an analogue clock face and/or a digital clock, both of which should be showing the correct time provided you set the time by running of Intro.

Gomoku. This is a fairly standard board game involving trying to beat the computer to getting a row of five counters on a square matrix board. It is well set out and plays a good game, but totally silent, which seems a shame.

Patterns produces a series of line patterns in high resolution graphics from two seed numbers which you input from the keyboard. They are effectively Moire patterns but are in multiple colours using the exclusive -OR function.

Marslander is a 'Lunar Lander' program involving the use of a rocket motor to slow down a ship to land on a rocky terrain. Having landed, you take off again and attempt to land a certain distance away from the original landing site.

Bugzap is again a traditional sort of program involving a bug attacking your base on the ground. Your job is to zap the bug before it drops a bomb on you.

Island. Those of you who have seen Acornsoft's *Creative Graphics* will recognise this program. The picture, which is generated by loading data from tape which takes several minutes, is of an island with some palm trees on it in the middle of an ocean with moving waves – a very clever effect.

Planets uses the same technique as Island to produce an impressive picture of a number of planets with orbiting satellites. The sense of motion and rotation is quite startling.

Bye. This brings the package to an end with a plug for Acornsoft.

THE ELK'S 'MOS' ROLL CALL

THE BBC micro has, hidden in its machine operating system ROM, a message which contains the names of some of those who were involved in designing the computer, and exactly the same is true of the Electron. The machine operating system takes up only 15.25k in a 16k ROM, which means there is 0.75k which can be used for memory-mapped input/output while the MOS ROM is disabled.

To read that 3/4k, it is necessary to take the chip out and use another computer. I achieved this by putting it into one of the sideways ROM sockets on a BBC micro. Having done this, it is possible to use a machine code monitor to simply read the message. If you do so, this is what you will find:

(C) 1983 Acorn Computers Ltd. Thanks are due to the following contributors to the development of the Electron (among others too numerous to mention):- Bob Austin, Astec, Harry Barman, Paul Bond, Allen Boothroyd, Ben Bridgewater, Cambridge, John Cox, Chris Curry, 6502 designers, Jeremy Dion, Tim Dobson, Joe Dunn, Ferranti, Steve Furber, David Gale, Andrew Gordon, Martyn Gilbert, Lawrence Hardwick, Hermann Hauser, John Herbert, Hitachi, Andy Hopper, Paul Jephcot, Brian Jones, Chris Jordan, Computer Laboratory, Tony Mann, Peter Miller, Trevor Morris, Steve Parsons, Robin Pain, Glyn Phillips, Brian Robertson, Peter Robinson, David Seal, Kim Spence-Jones, Graham Tebby, Jon Thackray, Topexpress, Chris Tuurner, Hugo Tyson, John Umney, Alex van Someren, Geoff Vincent, Adrian Warner, Robin Williamson, Roger Wilson.

Those of you who have seen the BBC MOS message will notice that many of the names are the same, but there are a number of additions.



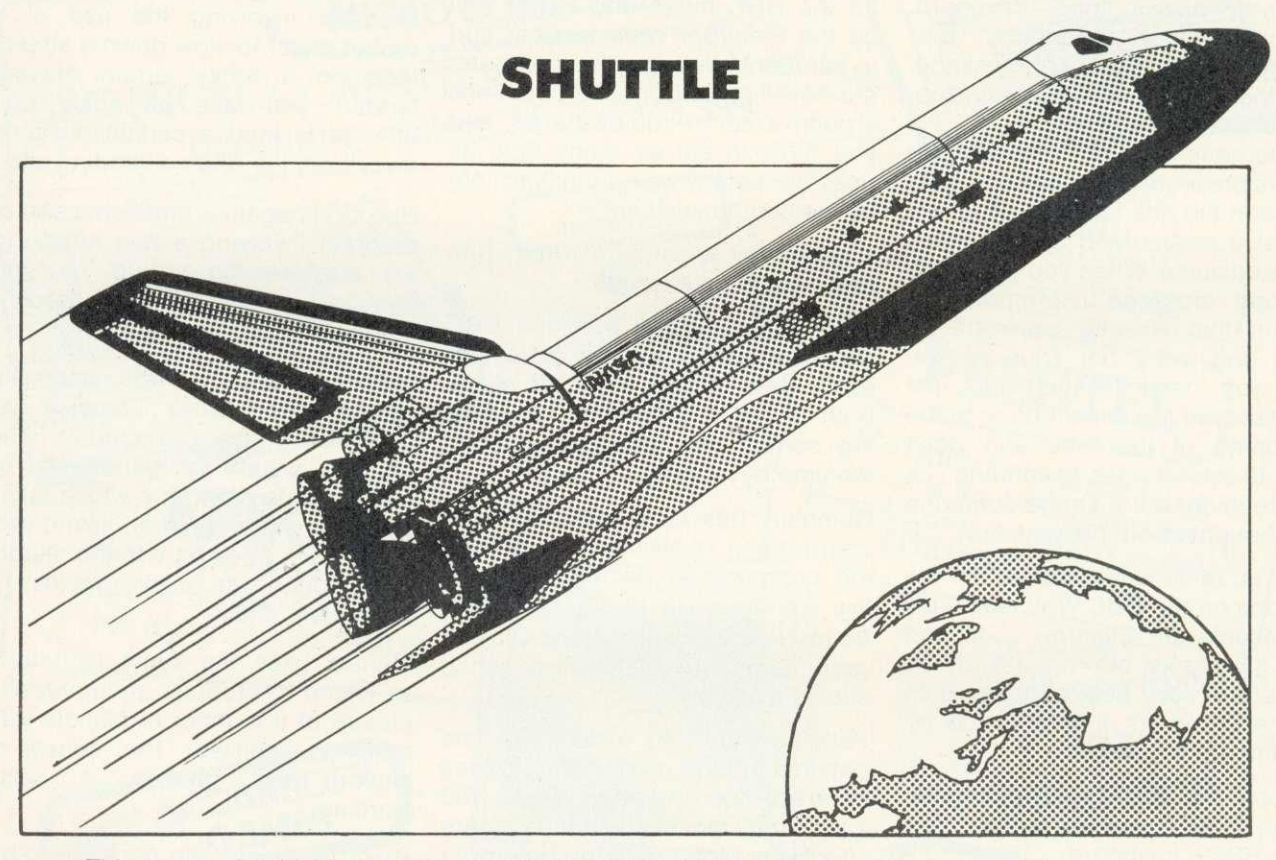
Software News



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SHUTTLE



This program is a highly accurate computer simulation of the flight of the Space Shuttle Columbia from the initial countdown through the launch period, the launch itself and into a stable orbit. The craft may be manoeuvred within the orbit and then dropped out to finally fly through the atmosphere to a safe touchdown.

The attraction of this simulation is its authenticity. So far as is possible, it follows the actual parameters of the first Columbia flight with only one or two minor exceptions. The shuttle, of course, starts its flight pointed vertically into the sky and carries a huge fuel tank to provide the fuel for its three main engines in addition to the solid fuel rockets which provide the major thrust to lift it off the ground. Two minutes into the flight the rockets are jettisoned, having burned all their fuel. The count-down for take off starts at T-20 seconds. At T-10 seconds the shuttle motors start firing, but the shuttle remains tethered until T = 0. When the shuttle blasts off, the pilot must guide the craft into its orbit by controlling its attitude and track. A number of guidance controls are supplied, together, of course, with control of the shuttle motors' thrust.

The simulation may be started at one of three points in time: either at take off, at a point where the Columbia is in a stable orbit round the earth, or finally, prior to landing. Measurements of speed, fuel and so on may be selected for either Metric or Imperial measurements. All of the physical forces which acted upon the actual flight are taken into account. One departure from fact has been included in that the two solid fuel rockets have had their thrusts increased from 26 to 36 million Newtons so as to give the pilot an increased latitude for error. In other words to make the take off easier.

A fascinating program, the more so because it follows fact so closely. Available for the Model B

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PAINTING BY TEXTURES

Jim McGregor and Alan Watt use joystick and keyboard for plotting, painting and colour mixing to produce patterns

This article brings together, and expands upon, some of the techniques on interactive graphics (*Acorn User*, June) and colour fill (August).

An interactive design package should combine techniques for producing line drawings with colouring facilities and this is provided by program 1. Although written in Basic, the colour mix and fill is almost as quick as commercial packages.

In June's issue, we used keys, L(eft), R(ight), U(p), D(own) to control the cursor in a 'rubber-banding' program. There are many more convenient ways for inputting line drawings and program 1 demonstrates how a single joystick and fire-button can be used in rubber-banding. This is probably the most widely available (and cheapest) analogue input device. Similar programming techniques could be used to drive the program with a lightpen (*Acorn User*, March) or with a graphics tablet or pad. If you have none of these, you can of course revert to the keyboard.

A graphics tablet is a device that tracks the position of a pen as it is moved over a sensitive surface. Using four keys, a lightpen, or a graphics tablet to input graphic material makes little difference to the program's structure. The task of the computer is to continuously sample the (x,y) position of the device as it is moved. In a key program we simply add a constant (4 for mode 1) every time a key is pressed. In a joystick program we use ADVAL to sample the position of the potentiometer in the device, and with a graphics tablet we have to process a continual stream of coordinates. The rate at which these coordinates are supplied from the table varies from manufacturer to manufacturer and a program using such a device may have to reduce the volume of information if the coordinates are to be stored.

Although the programming techniques for these devices differ little, the ease of use varies tremendously. It is very difficult to draw a continuous curve with L, R, U, D keys. It is somewhat easier with a joystick but you will find joysticks quite difficult to control. Using a graphics tablet, drawing a shape into the computer is as easy as drawing on paper, and in fact these devices can be used for signature validation.

The differences are of course reflected in the prices. Using the keyboard costs nothing, joysticks cost about £15 and a graphics tablet will cost between £500 and £1,000. Hence we will restrict ourselves to joysticks and keys.

In program 1, the joystick is used to move the cursor and the fire-button is used to 'fix' a point. In addition, keys are used to switch the cursor on or off (C) and to switch line plotting on or off (O). The program runs in mode 1, and lines are always drawn in red. (A valuable exercise to improve your understanding of the program would be to implement extra key commands for changing the colour of the rubber-band line.) Note that we can make the joystick behave almost like a graphics tablet by holding down the fire button continuously as the device is moved.

If you do not have a joystick, convert the program to keyboard control, by changing the lines given after the main program listing. Program 1 includes fairly limited colouring facilities. The user can use a key to select one of three colours, W(hite), R(ed), Y(ellow) and the region containing the cursor is filled with the selected colour. Note that the region to be filled must be completely surrounded by a boundary. If not, the colour will 'leak' out through any gaps into other regions – a well-known phenomena, graphically known as bleeding.

The colouring algorithm in program 1 is an extended version of the line-queueing algorithm (August article). The extensions have been included to colour not only the selected region, but also the points on its boundary. This means the region can be coloured without leaving a different coloured outline. In PROCfillalong, we use PLOT 76 (OS 1.2 only) to find the extent of a horizontal line of background colour. This line and its two boundary points are then coloured by drawing a line from the pixel before the start of the line to the pixel after the end of the line. This is done by the procedure PROCcolour which will be extended later. In PROCfindback, the IF statement at line 900 is used to change the colour of any horizontal boundary runs.

In May's *Acorn User*, Peter Voke showed that, by mixing colour on the screen in different patterns, the programmer could obtain the effect of many more than the four colours available in mode 1, or the eight in

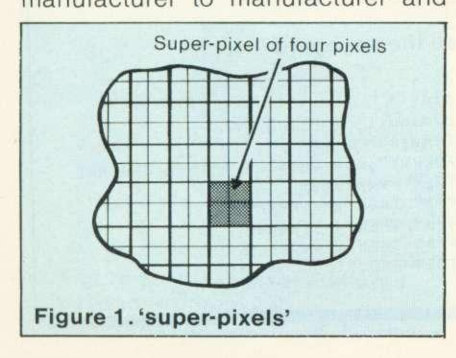


Figure 1. 'super-pixels'

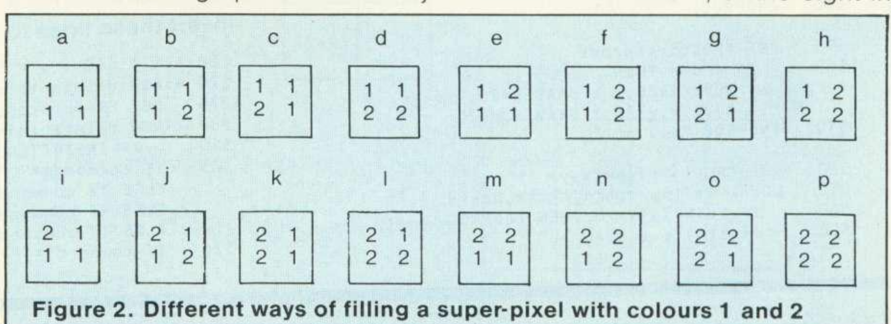


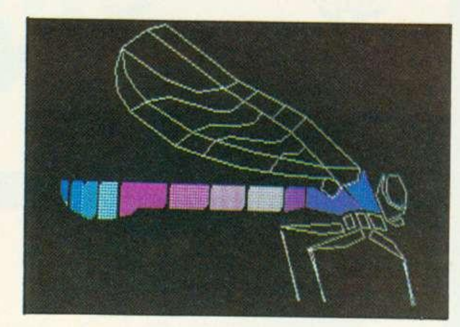
Figure 2. Different ways of filling a super-pixel with colours 1 and 2



mode 2. Let us see how we can use such colour mixing in our painting program.

Because we are writing an interactive program, it is important that any method we use for mixing colours should result in fairly fast filling. It is possible to extend our colouring algorithm so an arbitrary region is filled with a colour mixture almost as fast as it is filled with pure colour by program 1!

First of all, examine the basic mixture patterns we shall use for combining colours. Any region to be coloured will be divided into blocks, each two pixels square – a 'super-pixel' (figure 1). By plotting a selection of different colours in a super-pixel and repeating this



Program 1. Joystick rubber-banding and painting

```
10   DIM CPblock 8
20   DIM fromxq(100),toxq(100),yq(100)
30   xstep=4 : ystep=4
40   MODE 1
50   lineon = TRUE
60   cross = TRUE
70   xs = 0 : ys = 0
80   PROCreadjoystick : x=jx : y=jy
90   GCOL 3, 1
100  PROCdrawordelete
110  REPEAT
120    PROCrubber
130    PROCprocesscommand
140  UNTIL command$ = "Q"
150  MODE 7 : END
160  DEF PROCrubber
170    PROCreadjoystick
180    IF ABS(x-jx)<4 AND ABS(y-jy)<4 THEN ENDPROC
190    PROCdrawordelete
200    x=jx : y=jy
210    PROCdrawordelete
220  ENDPROC

230  DEF PROCreadjoystick
240    jx = 1280 - ADVAL(1) DIV 52
250    jy = ADVAL(2) DIV 64
260  ENDPROC

270  DEF PROCprocesscommand
280    IF (ADVAL(0)AND 3)>0 THEN
         PROCdrawordelete:PROCfix:
         PROCdrawordelete:ENDPROC
290    command$=INKEY$(0)
300    IF command$="" THEN ENDPROC
310    IF INSTR("OCWYR",command$) = 0 THEN ENDPROC
320    PROCdrawordelete
330    IF command$="W" THEN
         GCOL 0,3 :PROCfillfrom(x,y):GCOL 3,1
340    IF command$="R" THEN
         GCOL 0,1 :PROCfillfrom(x,y):GCOL 3,1
350    IF command$="Y" THEN
         GCOL 0,2 :PROCfillfrom(x,y):GCOL 3,1
360    IF command$ = "O" THEN lineon = NOT lineon
370    IF command$ = "C" THEN cross = NOT cross
380    PROCdrawordelete
390  ENDPROC

400  DEF PROCdrawordelete
410    PROCcheckcross
420    IF lineon THEN MOVE xs, ys : DRAW x,y
430  ENDPROC
440  DEF PROCfix
450    GCOL 0,1 : IF lineon THEN
                MOVE xs,ys : DRAW x,y
460    GCOL 3,1
470    xs = x : ys = y
480  ENDPROC

490  DEF PROCcheckcross
500    IF cross THEN
         MOVE x-20,y : DRAW x+20,y :
         MOVE x,y-20 : DRAW x,y+20
510  ENDPROC

520  DEF PROCfillfrom(x,y)
530  LOCAL leftx,rightx,nextx,backx
540    IF POINT(x,y)>0 THEN ENDPROC
550    first=1 : last=0
560    PROCfillalong(x,y)
570    PROCqueue(leftx,rightx,y)
580    REPEAT
590      PROCunqueue
600      PROCcheckalong(y+ystep)
610      PROCcheckalong(y-ystep)
620    UNTIL first=last+1
630  ENDPROC

640  DEF PROCcheckalong(y)
650  LOCAL nextx
660    IF POINT(fromx,y)=0 THEN
         nextx=fromx
       ELSE PROCfindback(fromx,y):nextx=backx
670    IF nextx>tox THEN ENDPROC
680    REPEAT
690      PROCfillalong(nextx,y)
700      PROCqueue(leftx,rightx,y)
710      PROCfindback(nextx,y)
720      nextx=backx
730    UNTIL nextx>tox
740  ENDPROC

750  DEF PROCfillalong(x,y)
760    PLOT 76,x,y
770    X%=CPblock : Y%=CPblock DIV 256
780    A%=&0D : CALL &FFF1
790    leftx=!CPblock MOD 65536
800    rightx=!(CPblock+4) MOD 65536
810    PROCcolour(leftx-xstep,rightx+xstep,y)
820  ENDPROC

830  DEF PROCfindback(x,y)
840  LOCAL lastx
850    PLOT 92,x,y
860    X%=CPblock : Y%=CPblock DIV 256
870    A%=&0D : CALL &FFF1
880    lastx=!(CPblock+4) MOD 65536
890    backx=lastx+xstep
900    IF lastx>tox THEN
         PROCcolour(x-xstep,tox+xstep,y)
       ELSE PROCcolour(x-xstep,lastx,y)
910  ENDPROC
920  DEF PROCqueue(fx,tx,y)
930    last=(last+1)MOD 100
940    fromxq(last)=fx : toxq(last)=tx
950    yq(last)=y
960  ENDPROC

970  DEF PROCunqueue
980    fromx=fromxq(first) : tox=toxq(first)
990    y=yq(first)
1000   first=(first+1)MOD 100
1010 ENDPROC

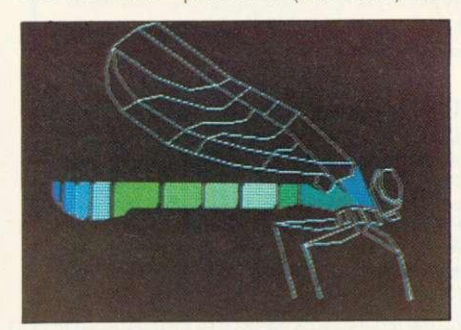
1020 DEF PROCcolour(x1,x2,y)
1030   MOVE x1,y : DRAW x2,y
1040 ENDPROC
```

Insert these lines to use the keyboard

```
80     x = 640 : y = 512
120  **REM delete this line**
270    DEF PROCprocesscommand
280  **REM delete this line**
310      IF INSTR("LRUDFOCRWY",command$) = 0 THEN ENDPROC
325    IF command$="L" THEN x=x-xstep
       ELSE IF command$="R" THEN x=x+xstep
       ELSE IF command$="U" THEN y=y+ystep
       ELSE IF command$="D" THEN y=y-ystep
326    IF command$="F" THEN PROCfix
```

colour pattern in the other super-pixels over the region being coloured, we can create the effect of many different shades.

We cannot use colour 0 in our colour mixtures as the colour-fill algorithm would recognise this as a background point. However, colours 1, 2 and 3 can be mixed in any combination within a pixel. There are 81 such patterns (3x3x3x3) for



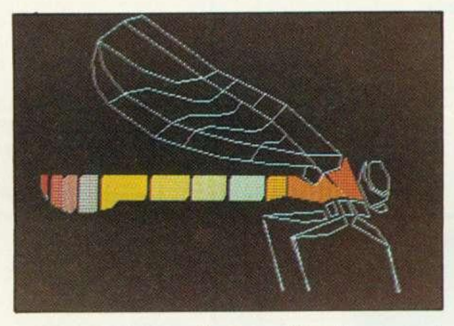
one super-pixel, but many of these patterns are equivalent when spread over a region. If colours 1 and 2 have their default settings for mode 1, mixing them will give various shades of orange.

Figure 2 shows the 16 ways of combining colours 1 and 2 in a super-pixel. 'Mixture a' is, of course, pure red and 'mixture p' is pure yellow.

Now look at mixtures b, c, e and i. Each of these contains three red pixels and one yellow. If one of these mixtures is repeated over a large region, the overall result will be the same – mainly red with an occasional spot of yellow. A high-quality monitor may show up the individual spots of yellow, but on most televisions, the pixels will merge together to produce a reddish-orange effect. Whether the colours mix into a flat shade with individual pixels invisible depends not only on the monitor resolution but also on the contrast between the colours.

Mixtures d, f, g, j, k and m all contain equal proportions of red and these will all create an orange effect. Whether or not the horizontal, vertical or diagonal stripes of the underlying colours can be seen will again depend on the television or monitor.

Finally, mixtures h, l, n and o each contain three yellow pixels and one red. Thus, out of the 16 different mixing patterns in figure 2, there are really only three different shades apart from the two basic colours. In addition, the shades that contain equal quantities of the two basic colours can be categorised

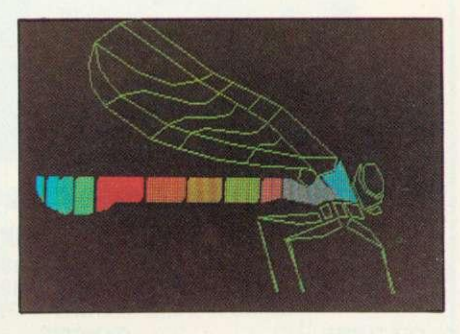


into horizontally, vertically, and diagonally banded mixtures which will result in differences in texture of the resulting shade. We shall say more about such variations shortly.

If we now allow colours 1, 2 or 3 to be mixed within a pixel, then, out of the 81 different ways of combining three different colours, there are 15 different proportions in which the colours can be used. The ways in which we shall obtain these proportions in program 2 are illustrated in figure 3. Thus, in addition to the background colour, we shall provide 15 different foreground shades. With the default colour settings in mode 1, these shades will be combinations of red, yellow and white giving shades of orange, pink, primrose and cream. Of course, the basic palette can be changed using VDU 19 statements to set colours 1 to 3 to any three of the eight available. This extends the range to several hundred possible shades, although only 15 can appear at once. Some of the possibilities are illustrated in the dragonfly photographs (using only two-colour mixtures).

Now we come to the problem of laying down one of these colour mixtures in a region surrounded by a boundary. For a given mixture, the colour for a single pixel will depend on that pixel's horizontal and vertical position. The colouring algorithm in program 1 works by colouring horizontal rows of pixels and so we shall concentrate on how to apply the appropriate sequence of colours to such a row.

Only two colours out of the mixture being used will be needed on any one horizontal row (figure 4). On a given row, the two colours are applied to alternate pixels. To colour a horizontal row of pixels, we first need to decide which two



1	2	3
1 1 1 1	2 2 2 2	3 3 3 3
4	**5**	**6**
1 1 1 2	1 2 2 1	1 2 2 2
7	**8**	**9**
1 1 1 3	1 3 3 1	1 3 3 3
10	**11**	**12**
2 2 2 3	2 3 3 2	2 3 3 3
13	**14**	**15**
1 2 3 1	2 1 3 2	3 1 2 3

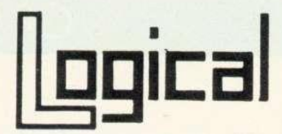
Figure 3. Super pixel mixtures used in Program 2

Super pixel colour

C1	C2
C3	C4

Colours C1 and C2 alternate on this row	C1	C2	C1	C2 ......
Colours C3 and C4 alternate on this row	C3	C4	C3	C4 ......

Figure 4. Applying colours to alternate rows



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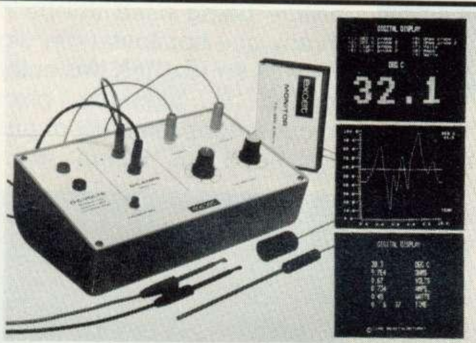
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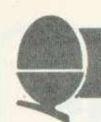
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Program 2. Painting with colour mixing (alterations to program 2 shown)

```
      .
      .
      .
21   DIM col(15,1,1)
22   FOR mix=1 TO 15
23     FOR cy=1 TO 0   STEP -1:FOR cx=0 TO 1
24       READ col(mix,cx,cy)
25   NEXT:NEXT:NEXT
26   DATA 1,1,1,1, 2,2,2,2, 3,3,3,3,
          1,1,1,2, 1,2,2,1, 1,2,2,2,
          1,1,1,3, 1,3,3,1, 1,3,3,3,
          2,2,2,3, 2,3,3,2, 2,3,3,3,
          1,2,3,1, 2,1,3,2, 3,1,2,3
      .
      .
      .
270  DEF PROCprocesscommand
280    IF (ADVAL(0)AND 3)>0 THEN
         PROCdrawordelete:PROCfix:
         PROCdrawordelete:ENDPROC
290    command$=INKEY$(0)
300    IF command$="" THEN ENDPROC
310    IF INSTR("OCP",command$) = 0 THEN ENDPROC
320    PROCdrawordelete
330    IF command$="P" THEN PROCpaint
340  **REM DELETED
350  **REM DELETED
360    IF command$ = "O" THEN lineon = NOT lineon
370    IF command$ = "C" THEN cross = NOT cross
380    PROCdrawordelete
390  ENDPROC

392  DEF PROCpaint
393    INPUT TAB(0,0),"colour mix(1..15)",mix
394    PROCfillfrom(x,y):GCOL 3,1
395    PRINT TAB(0,0);SPC(25)
396  ENDPROC
      .
      .
      .
1020 DEF PROCcolour(x1,x2,y)
1030 LOCAL cx,cy, c1,c2
1040   cy=y DIV ystep MOD 2 : cx=x DIV xstep MOD 2
1050   c1=col(mix,cx,cy) : c2=col(mix,1-cx,cy)
1060   GCOL 0,c1 : MOVE x1,y : PLOT 21,x2,y
1070   IF x1=x2 THEN ENDPROC
1080   GCOL 0,c2 : MOVE x1+xstep,y : PLOT 21,x2,y
1090 ENDPROC
```

colours are to be used and then to apply these to alternate pixels. (For some mixing patterns, the two colours may be the same.) The obvious way of filling alternate pixels on a row is to visit each pixel individually and use PLOT 69 with the appropriate colour. However, this is unacceptably slow and there is a better method.

If the dotted-line plotting command (PLOT 21) is applied between two points with the same y-coordinates, this results in alternate pixels being filled with the current foreground colour. Thus, to fill pixels alternately with two colours, we can plot a dotted line in one of the colours starting at the extreme left of the row and then plot another dotted line in the other colour starting one pixel in from the left! This trick enables us to colour-fill a region extremely rapidly.

The only remaining problems are how to select the two colours on a given horizontal line and how to select the first colour.

We shall store the various mixing patterns (figure 3) in a three-dimensional array 'col' whose first subscript selects one of 15 different mixing patterns. Each of the other two subscripts is in the range 0 to 1. We can picture the array 'col' as a collection of 15 two-dimensional arrays, each representing a super-pixel colour combination. Each super-pixel has the structure illustrated in figure 5.

Program 2 is a modified version of program 1 which permits regions to be coloured in any one of the 15 different colour mixtures. Instead of typing one of the codes R, Y or W, the user now types P (for Paint) and is then asked to choose a colour-mix (1 to 15).

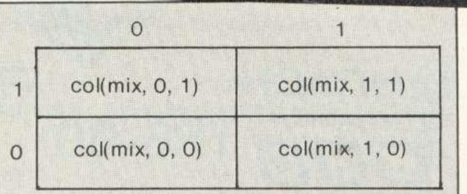


Figure 5. Structure of each possible colour mix as represented in the array 'col'

The structure of the colouring algorithm is the same as before. The array 'col' has to be initialised to store the 15 different colour-mixing patterns. The only other change is in the definition of PROCcolour. Line 1040 is used to calculate the two subscripts for 'col' needed to extract the first colour for the current row. We only need to extract colours for the first two pixels on the row (line 1050) and the whole row is filled by drawing dotted lines starting at these two pixels (lines 1060 and 1080).

As we saw earlier, different ways of applying two colours in the same proportions can result in variations of texture. This may be undesirable in colour mixing, but can be positively exploited in computer art. You can experiment with global variations of texture – cross-hatching, etc – in program 2 by trying different DATA statements in line 26. Compare the three mixing patterns:

1,1,2,2   1,2,1,2   1,2,2,1

If we forego the advantages of rapid filling with the dotted line technique and carry out calculations similar to those at line 1040 for each pixel to be filled, there are many interesting textures with which we could experiment. Some of the textures used in weaving are illustrated in figure 6.

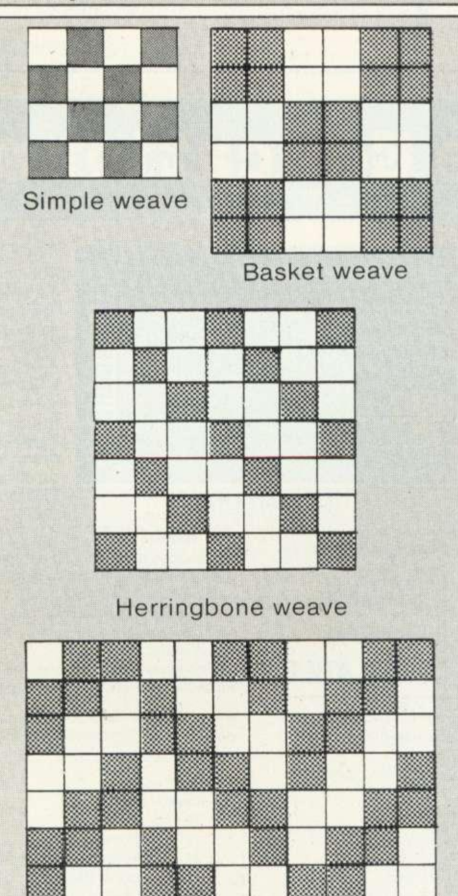
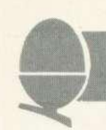


Figure 6. 'Regular' textures used in weaving



DARING DEEDS WITH DISCS

Joe Telford explores the dark side of Acorn's disc filing system

A major item to add to the Beeb is a disc drive. However, the result removes a good deal of valuable memory space between &E00 and &1900. This is 11 pages or blocks of memory, which at 256 bytes per page works out at a hefty 2.75k of lost memory. Readers have written in bemoaning this, which has encouraged me to examine the disc workspace more closely.

Figure 1 gives a memory map of the current disc workspace. It is not complete because time is never on my side and, because some say it's naughty to delve into this area, no official information is available, other than from Acorn's DFS manual. Actually, DFS chips exist from V0.90 to V0.9E at least, and probably further now (although Acorn has only officially released V0.90). There is no reason why each version shouldn't use workspace differently, though I would expect the major buffers to remain. Please note therefore, that figure 1 refers to workspace for a V0.9E DFS chip (though the information should be OK with other versions.)

Practically speaking, I have had few problems in using some of this workspace, although how much can be used depends on your application. Before continuing, I should mention that it is far better to use the space above &1900 for Basic on a DFS than it is to work below it – and Acorn would no doubt disapprove. However, in experiments I have had success with the pages given in figure 2.

There is no simple way of moving PAGE below &1100 and still retaining any useful DFS facilities. Indeed, moving PAGE between &1900 and &1100 must be regarded as dangerous because the program can become corrupted by opening files unwisely, or even on break.

One of the most useful areas of DFS workspace is to be found in the two pages beginning &E00 and extending to &FFF. This is where

Program 1. Examines disc workspace

```
10VDU2
20start=&E00
30 FOR page =1 TO 2
35  FOR line= 1 TO 32
40  PRINT;-start;" ";
50   FOR linepos = 0 TO 7
60   content = linepos?start
70   PRINT;-content" ";
80   NEXT
85  PRINT"    ";
90   FOR linepos = 0 TO 7
100  content = linepos?start
110  IF content<32 OR content>126
     PRINT"."; ELSE PRINTCHR$content;
120  NEXTlinepos:PRINT:start=start+8
130  NEXTline:PRINTCHR$12
140 NEXTpage
150VDU3:END
```

&D00	General Workspace
&E00	Copy of track 0 sector 0 (with variations)
&F00	Copy of track 0 sector 1
&1000	General workspace
&1100	Parameter blocks for files EXEC/SPOOL etc.
&1200	EXEC/ SPOOL/ 1st file buffer
&1300	2nd file buffer
&1400	3rd file buffer
&1500	4th file buffer
&1600	5th file buffer
&1700/1800	Further workspace

Figure 1. DFS workspace block memory map

New value of page:	Facilities available to Basic
&1800	SAVE LOAD EXEC SPOOL 5 open files
&1700	SAVE LOAD EXEC SPOOL 5 open files
&1600	SAVE LOAD EXEC SPOOL 4 open files
&1500	SAVE LOAD EXEC SPOOL 3 open files
&1400	SAVE LOAD EXEC SPOOL 2 open files
&1300	SAVE LOAD EXEC SPOOL 1 open file
&1200	SAVE LOAD
&1100	SAVE LOAD
&1000 and lower	Not possible to use programs

Figure 2. Lowering PAGE




```
E00 41 42 43 44 45 46 47 48   ABCDEFGH  1st 8 chrs of title
E08 D6 20 20 20 20 20 20 00   .       . each file name
E10 E1 75 73 65 70 74 32 77   .usept2w  1 file/line
E18 C4 55 4D 50 20 20 20 00   .UMP    . (1st chr coded)
E20 C8 49 4A 4B 4C 4D 4E 00   .IJKLMN.  etc..
E28 F8 76 69 65 77 6D 20 00   .viewm  .
E30 D6 4D 20 20 20 20 20 00   .M      .
E38 CF 2F 4F 55 54 31 20 00   ./OUT1  .
E40 CD 6F 67 67 79 20 20 00   .oggy   .
E48 CD 45 4D 20 20 20 20 00   .EM     .
E50 E1 75 73 65 70 74 31 77   .usept1w
E58 E1 75 67 34 20 20 20 77   .ug4    w
E60 CB 49 53 53 4F 20 20 00   .ISSO   .
E68 E1 75 67 33 20 20 20 77   .ug3    w
E70 E1 75 67 32 20 20 20 77   .ug2    w
E78 E1 75 67 31 20 20 20 77   .ug1    w
E80 C1 44 4D 49 54 20 20 00   .DMIT   .
E88 CC 55 43 4B 4E 4F 20 00   .UCKNO  .
E90 D3 54 52 4F 4E 47 4F 00   .TRONGO.
E98 00 00 00 00 00 00 00 00   ........
EA0 00 00 00 00 00 00 00 00   ........
EA8 00 00 00 00 00 00 00 00   ........
EB0 00 00 00 00 00 00 00 00   ........
EB8 00 00 00 00 00 00 00 00   ........
EC0 00 00 00 00 00 00 00 00   ........
EC8 00 00 00 00 00 00 00 00   ........
ED0 00 00 00 00 00 00 00 00   ........
ED8 00 00 00 00 00 00 00 00   ........
EE0 00 00 00 00 00 00 00 00   ........
EE8 00 00 00 00 00 00 00 00   ........
EF0 00 00 00 00 00 00 00 00   ........
EF8 00 00 00 00 00 00 00 00   ........
```

Figure 3. Contents of page beginning &E00

```
F00 49 4A 4B 4C 51 90 01 90   IJKLQ...  last 5 chrs title
F08 00 00 00 00 DA 00 00 C4   ........  info on each file
F10 00 00 00 00 66 05 00 BE   ....f...  (1 file / line )
F18 00 00 00 00 4A 14 00 FB   ....J...  ( "    "   "    " )
F20 00 00 00 00 00 00 00 FB   ........  ( "    "   "    " )
F28 00 00 00 00 D6 00 00 BD   ........  etc
F30 00 19 23 80 13 01 CC BB   ..#.....
F38 00 19 23 80 13 01 CC B9   ..#.....
F40 00 00 00 00 00 00 00 B9   ........
F48 00 00 00 00 DC 00 00 B8   ........
F50 00 00 00 00 DF 0E 00 A9   ........
F58 00 00 00 00 D6 07 00 A1   ........
F60 00 19 23 80 70 11 CC 8F   ..#.P...
F68 00 00 00 00 AA 1D 00 71   .......q
F70 00 00 00 00 66 1A 00 56   ....f..V
F78 00 00 00 00 39 27 00 2E   ....9'..
F80 00 19 23 80 00 10 CC 1E   ..#.....
F88 00 19 23 80 FB 07 CC 16   ..#.....
F90 00 19 23 80 44 13 CC 02   ..#.D...
F98 00 00 00 00 00 00 00 00   ........
FA0 00 00 00 00 00 00 00 00   ........
FA8 00 00 00 00 00 00 00 00   ........
FB0 00 00 00 00 00 00 00 00   ........
FB8 00 00 00 00 00 00 00 00   ........
FC0 00 00 00 00 00 00 00 00   ........
FC8 00 00 00 00 00 00 00 00   ........
FD0 00 00 00 00 00 00 00 00   ........
FD8 00 00 00 00 00 00 00 00   ........
FE0 00 00 00 00 00 00 00 00   ........
FE8 00 00 00 00 00 00 00 00   ........
FF0 00 00 00 00 00 00 00 00   ........
FF8 00 00 00 00 00 00 00 00   ........
```

Figure 4. Page &F00 contents

the DFS stores the most up-to-date copy of the catalogue on the currently accessed disc. The benefit of having this copy in memory is that we don't need to worry just yet about how to handle discs via the operating system, although it isn't that difficult. First we need a program to look at memory, and program 1 is suitable for our needs.

Program 1 is set up to examine pages &E and &F in memory, but could be adapted to start anywhere by altering line 20. Line 25 sets the number of displayed pages. Because of the size of each page, it is best to dump to a printer, hence the form feed of line 130. If you lack a printer, simply remove the VDU commands at start and finish of the program, remove the PRINT CHR$12 of line 130 and select page mode (CTRL-N) before running the program. Figures 3 and 4 show the contents of pages beginning &E00 and &F00 respectively, but need explanation.

The organisation of page &E00 varies depending on the last disc command. Figure 3 is the result of a *. (*CAT) command, and hence is strangely coded. Page &E00 is more understandable after a LOAD or SAVE command. Page &E00 is however a copy of the information on track 0, sector 0 of the current disc, and as such can be broken down into two parts. Part one (the first line) is the first eight characters, in ASCII, of the current disc's title. The second part is simply as many eight-character filenames as will fit onto the remaining 248 bytes. Simple division shows this to be 31, thus accounting for the much queried maximum size of the catalogue. Examining each filename in turn we meet our next problem. Look at this filename from figure 3.

E50 E1 75 73 65 70 74 31 77 .usept1w

The ASCII characters can be directly translated into English, except for the first and last. The first, ASCII &E1, seems high. However, subtracting &80 returns &61 – ASCII code for 'a'. On a *CAT, the first character in the filename seems to have bit 7, the most significant bit, set high. This translates the filename to 'ausept1w'. Because each filename can only be seven characters long, the last character of the eight shown is actually the filename extension and in common parlance needs to be repositioned at the beginning of the filename along with a full stop ie: 'w.ausept1', and we can now decode the filename as that given to the first part of this current article, though you will probably need my devious mind to work out the exact English translation. Look at this next filename and try to decode it:

E90 D3 54 52 4F 4E 47 4F 00 .TRONGO.

Yes, &D3-&80 = &53 = ASC("S"), which gives the file name STRONGO, but the extension is ASCII 0 which is the NUL character. If I was to alter the directory of the disc from '$' to 'w' this would show up as an ASCII &24 in the STRONGO filename, ie:

E90 D3 54 52 4F 4E 47 4F 00 .TRONGO$

while the ausept1 filename would



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alter to:

E50 E1 75 73 65 70 74 31 00 .usept1.

In other words, the current directory is referred to by 00 as the filename extension.

To make use of all this information, we should be aware of the principal contents of the page beginning &F00. This is a copy of the second part of the directory, and like the first part has two major components. Look at figure 4. The first line contains the last five characters of the title followed by the number of file entries, and the amount of disc space. Each of the other lines contains information on the files which can be shown during a *INFO command, and which is also used to set internal pointers when files are loaded into memory.

By examining figures 4, 5, 6 and 7 we can see that all the disc catalogue's information is actually available most of the time, within the BBC micro. This means that except when a disc has just been physically swapped, we have access to the catalogue information by simply inspecting memory.

This means we can produce a number of useful programs from Basic which take into account the programs currently on disc.

One very useful piece of software would allow us to produce an automatic menu of a disc, simply by loading it. Program 2 is just that. Type it in, save it as "MENU", and then *BUILD a file called !BOOT. This is a one-line file containing the line:

1 CHAIN "MENU"

Set up *OPT4,3 on the disc and it's ready to go. Whenever you shift-break, the menu program will load, list the files on your disc and ask which one is needed. Type its number followed by return, and that file will be chained as a Basic program.

The main parts of the program are:

- clear screen and cut text stream until *. is done.
- Print disc name using FN_title.
- For each file, print its name and give it a number using FN_assemble.
- Get the number of the file required by INPUT at line 400.
- Convert the number to a filename.
- Chain the filename indicated.

The reason for the first step is to ensure the workspace holds the most current version of the catalogue, to protect against disc swaps. Immediately after this, we check for an empty disc in line 330, and if this is the case we exit after a message from PROC_none. To ease the layout we use the

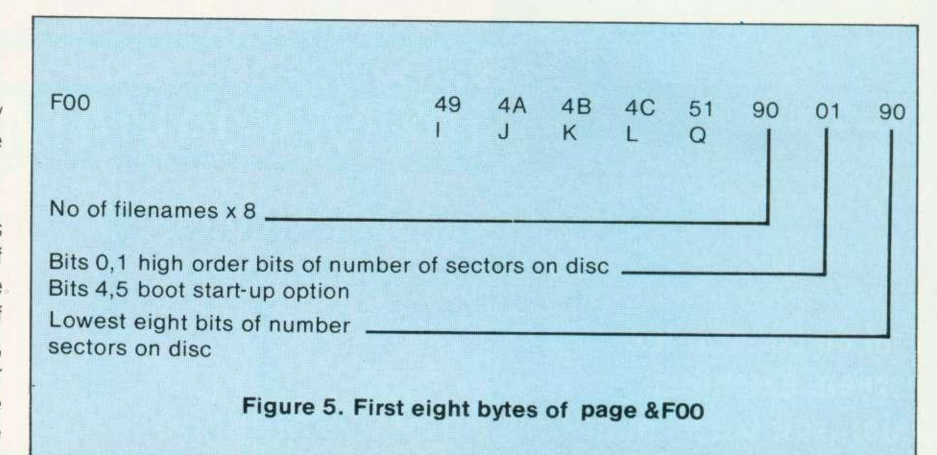


Figure 5. First eight bytes of page &F00

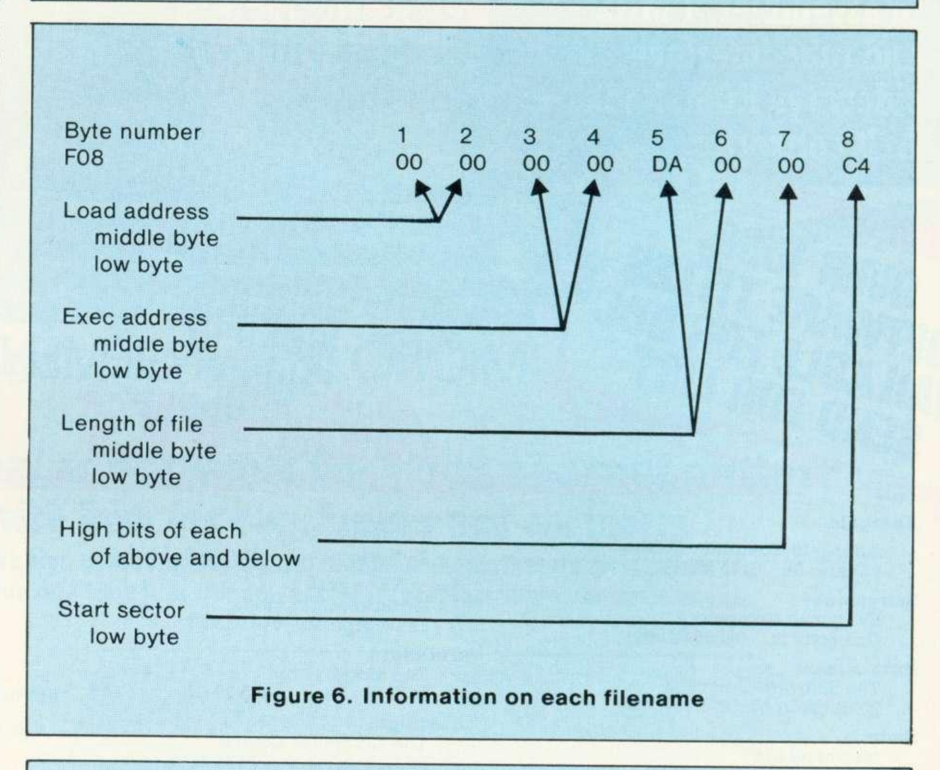


Figure 6. Information on each filename

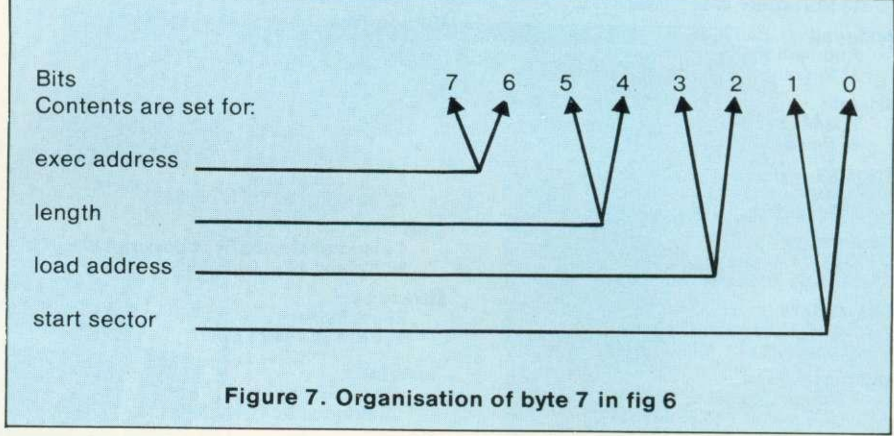


Figure 7. Organisation of byte 7 in fig 6

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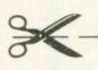
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numerical format variable @% which we change to 2, indicating two significant figures, but we must remember to reset it before exiting the program. This is done in lines 445 and 485.

Function FN_title simply takes the eight characters from &E00, adds them to the five from &F00, and returns this to the main body of the program where it can be printed in yellow (CHR$131).

FN_assemble is the most complex function. Its task is to put the nine-byte filename string together. It takes into account the directory code, and the set seventh bit of the first byte, and fits them together in the correct order, adding them to the body of the string. FN_assemble is used again, to assemble the target filename. This is why the function needs parameters of: start of workspace, item number to assemble, and length of item in bytes.

It is possible to alter the program in a number of ways, for example to ignore files beginning with a certain extension or directory name.

Code	Type of file
$	Machine code executed by *
B	Basic program file
S, G	Screen or graphics dump
H	Hex (ASCII) dump (2 bytes/chr)
D	General purpose data file
A, T	ASCII/Text file
W, V	File from Wordwise/View
C	File from Spreadsheet (Calc)
E, X	EXecuable program file for merging
M	Memory dump from area other than screen

Figure 8. Directory extension codes and meanings

Most of us rarely alter the directory on the BBC micro, yet this is a facility worthy of more use. It is becoming increasingly important for readers to set some standards with regard to these extensions, as we are becoming more aware of the different types of files available. Figure 8 is a list of some suggested directory extensions and their meanings.

I would be grateful for comments on the idea of directory codes and meanings. If, for example, you only deal with Basic programs, the extension could be based on application, or programmer's name eg: E.BUDGET might mean ECONOMICS/BUDGET while K.NICKERS could be a sort by Kitty, to find the top 10 policemen of all time!

Finally, a question: In the auto menu program I referenced a memory location &10CA which contained the ASCII value of the current directory. How did I find that location? Program 3 will start you off on your search.

Program 3. Searching memory

```
 10 REM** AUTO MENU ON DRIVE 0 **
 20 REM** Joe Telford (c) 1983 **
 30 REM** (c) Acorn User      **
 40 REM** September 1983      **
 50 ON ERROR GOTO320
 60 MODE7
 70 REM CLEAR SCREEN, DISABLE IT
 80 REM GET CURRENT DIRECTORY OF
 90 REM CURRENT DRIVE
100 CLS
110 *FX3,6
120 *.
130 *FX3,0
140 REM NOW LOOK AT CAT IN
150 REM MEMORY AND LIST IT.
160 start=&E00
170 nofiles=?(&F05) DIV 8
180 dir=&10CA
190 PRINT'CHR$131"DISC: ";FN_title(start,8)'
200 IF nofiles = 0 THEN PROC_none:END
210 @%=2
220 FOR I%= 1 TO nofiles
230   A$=FN_assemble(start,I%,8)
240   PRINTTAB(ABS(I% MOD 2 -1)*20,VPOS)I%," "A$;
250   IFABS(I% MOD 2 -1)*20 =20 PRINT
260   NEXT
270 REPEAT
280   PRINT''
290   INPUT"Which one? "number
300   UNTIL number>0 AND number<=nofiles
310 F$=FN_assemble(start,number,8)
320 MODE7
330 PRINT'''"Looking for "F$
340 @%=10
350 CHAIN F$
360 *FX3,0
370 MODE7
380 PRINT'':REPORT:PRINT" at ";ERL'"Bye."
390 @%=10
400 END
410 REM PROCS START HERE
420 DEF FN_assemble(S,N,L)
430 LOCAL fs$,ls$,j%,w$
440 fs$=CHR$(?(S+N*L)MOD 128)
450 ls$=CHR$(?(S+N*L+L-1))
460 IF ASC(ls$)=0 ls$=CHR$(?dir)
465 w$=ls$+"."+fs$
467 FOR j%=S+N*L+1 TO S+N*L+L-2
470   w$=w$+CHR$(?j%)
480   NEXT
490 =w$
500 DEF FN_title(S,L)
510 LOCAL j%,w$:w$=""
520 FOR j%=S TO S+7
530   w$=w$+CHR$(?j%)
540   NEXT
550 FOR j%=&F00 TO &F04
560   w$=w$+CHR$(?j%)
570   NEXT
580 =w$
590 DEFPROC_none
600 CLS
610 PRINT'''"Disc is empty."
620 ENDPROC
```

```
10INPUT'"STARTING POINT "A$
20A = EVAL(A$)
30INPUT'" HOW MANY BYTES "B$
40B = EVAL(B$)
50INPUT'" SEARCH FOR ASCII CODE "C$
60C = VAL(C$)
70FOR I% = A TO A+B
80IF ?I% = C PRINT I%
90NEXT
```

Program 2. Automatic menu

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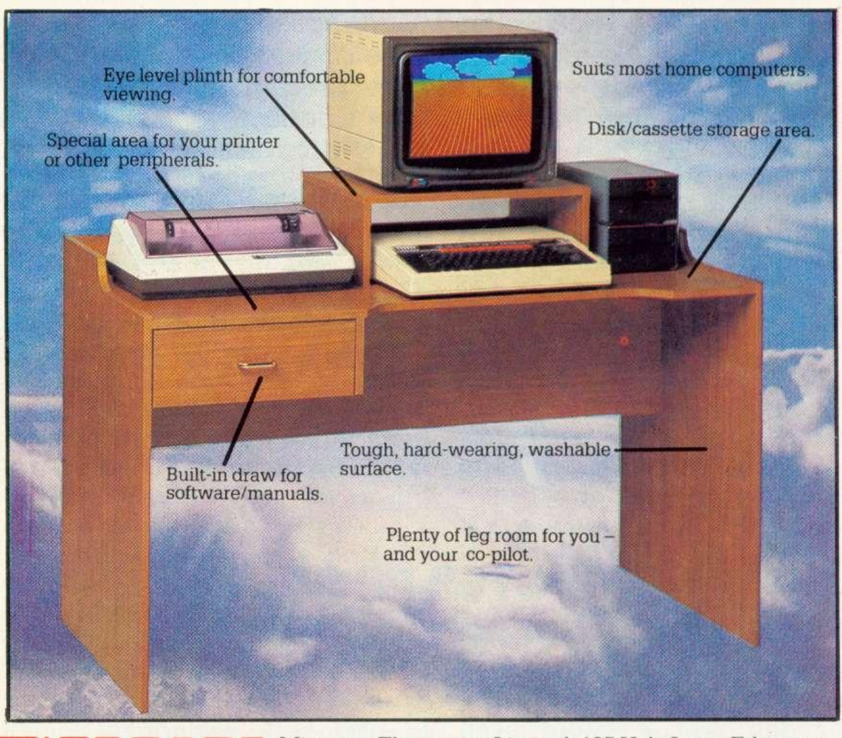
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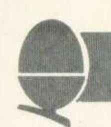
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IAN BIRNBAUM will answer reader's questions in this column and develop their ideas – as well as giving some of his own. But the real aim is for readers to provide the questions and answers. At least £5 will be paid for any tip published, with £10 for those which merit a one-star award and £20 for real humdingers! The idea must be original and be described clearly and fully. Your contribution should be typed or printed, with any substantial listings on cassette, but only included to make a point.

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PROBLEMS WITH MACHINE CODE PROGRAMS

IT IS worth pointing out that Mr Denis's BADPMC routine (May, page 42) will loop if the end of the bad program is missing or corrupted, as is the case if one accidently records over the end of a program on cassette.

Even inserting an &FF is not sufficient as to get out of LOOP2, as BADPMC must find a CR to mark the end of line.

Thus to rescue a program from cassette whose end is corrupted, one can:

i) note the number of uncorrupted blocks;
ii) load these and terminate the load with <ESCAPE>;
iii) PRINT~TOP
iv) ?<value of TOP–1>:=&FF (end of file marker);
v) ?<value of TOP–2>:=&0D (end of line marker);
vi) *RUN "BADPMC";
vii) CLEAR (to set LOMEM);
viii) correct and resave the program.

This has been tested on OS1.2 and BASIC II. I would like to acknowledge Mr P. Wells of Varndean High School, Brighton, who helped work this out! Tip from *Steve Ellacott of Brighton Poly.*

Some readers have had difficulty using BADPMC because they were unclear how to assemble and save the code. It might be worth saying a few words about this, since there are machine code programs in this Forum! Let's take Mr Denis's listing for our example.

When a program is written in assembly language, it is said to be *source code*. To execute the same code, it first has to be translated into *object code*, which here is machine code. The translation is done by the assembler, resident in the Basic ROM. Once translated, the source code has no further use: it is the object code that is executed to produce the desired effect.

So, returning to May's issue page 42, the listing given is source code. Type it in and save it, just as you would save a normal program, naming it "S.BADPMC". The S. reminds you that it is source code: its only function now is to act as a back-up copy to your machine code (which you are just about to produce).

Now RUN the program (a copy of which you've just saved). This will translate the source code and put the machine code in &C00 onwards. You must now save this machine code: do this by using *SAVE"BADPMC"C00 CFF.

Now, when you need to use Mr Denis's program you can *LOAD "BADPMC" and execute it by using CALL &C00; or more conveniently, just use *RUN "BADPMC". Remember that it is the machine code you want to execute: the source code has served its purpose *once it has been translated*.

DEBUGGING COPIED MAGAZINE LISTINGS

JOE Hanley from the Scilly Isles writes: I have had several failures with programs copied from magazines, including *Acorn User*. After checking for copying errors they still don't work! I assume I am doing something wrong, or there is a machine fault. The errors are *always* 'No such variable at line XXX'. For example the program Stars and Stripes in your April issue crashes at line 2010 DEF PROCVOX (X,Y,A,B). My crashes are always at similar lines. What am I doing wrong?

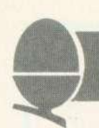
This is a common type of problem when copying listings, and the usual cause is spaces or their absence. Spaces are of more importance in BBC Basic than in most Basics. One reason for this is the provision of long variable names, where keywords can be embedded. For example, STARTTOFINISH is a valid variable name, and so you need to write FOR I=START TO FINISH if you want to avoid error.

This error is normally 'no such variable' since a variable like STARTTOFINISH doesn't have a value. (Note, in passing, that it is possible to write FOR I=START TO FINISH, because Basic recognises keywords at the start.)

Now your error could be caused by putting a space in the wrong place. A space between PROC and box will cause an error, but usually a 'no such FN/PROC at line XXX' error. Another possibility is that you are confusing 0 and O in line 220, but I assume you've checked this. The reason you need to check line 220 (or any other references to the PROC like 250) is because any 'no such variable' error in the reference will not be detected until the procedure is accessed. Thus an error in 220 (or 250 etc) will show up as an error in 2010. This is a common debugging problem, and it is as well to be aware of it.

There is one more possibility, though it doesn't fit your description. If in line 9040 you put I00 instead of 100, you would get a 'no such variable' error at line 3070. This is because you can put variables in DATA statements: If an attempt is made to read such a variable which has no value assigned, an error occurs at the READ statement line.

If none of these checks solve your problem, then you must have found a new debugging gremlin! Let us know.



SPLITTING MULTI-STATEMENT LINES by Rod Thomas



IN RESPONSE to the Forum article on program legibility in June's issue I have made the following modifications along the lines of your suggestions:

- Indenting of FOR. . .NEXT loops and REPEAT. . .UNTIL loops in LISTO7 is carried across to multiple statement lines. I have positioned the statements to start in the same column as single statements, the colon appearing in what would normally be a leading space. This seems the most legible arrangement.
- ELSE staements are detected and put onto a new line with an indent. Multiple statements in an ELSE block are also indented.
- Multiple statements in THEN blocks are also indented to aid legibility and be consistent with the ELSE blocks.

The routine (listing 1) begins by preserving the current character on the stack and checking for a colon, if found, subroutine SPACE is called. SPACE forces a new line, loads the accumulator with the number of indentations (number of FOR indents (&3B) plus number of REPEAT indents (&3C) plus number of THEN/ELSE indents (&70)) and transfers this value to the X-register. This is then used as a loop counter for printing the extra spaces required in indenting. Finally, the character is pulled back off the stack and written out.

If a colon is not found a check is made on the value of COUNT (location &1E) and if at the start of a new line the number of THEN/ELSE indents (&70) is cleared. This is necessary to remove the indenting introduced by previous IF. . .THEN . . .ELSE. . . statements.

To indent THEN blocks, the keyword IF is detected since THEN is optional. To detect a keyword such as IF or ELSE we need to know where the token is stored. The system 'decrunching' routine temporarily holds a token in location &37. However, simply detecting this token is not enough since it will be detected for each character of the keyword during decrunching and we do not wish to force a new line for each character! The Y-register is used as an index and so a check is made that it is zero indicating the first character of a keyword. If it is not, the character is simply written out. If it is, the token is checked for IF (&E7) and if so the THEN/ELSE indent counter (&70) is incremented and the character written out. If the token is ELSE (&8B) the counter is incremented, subroutine SPACE is called, an extra space is written to maintain alignment and the character written out from the stack

An added bonus of this routine is that FOR. . .NEXT and REPEAT. . . UNTIL loops which are embedded in multiple statement lines are correctly indented when listed on separate lines.

The routines to switch this listing option on and off are similar to Tony Hallam's with the addition that LISTO7 is selected when switched on and LISTO 0 when switched off.

```
10 V%=&20E:X%=?V%:Y%=V%?1:A%=X%+256*Y%
20 FOR PASS=0 TO 3 STEP3
30 P%=&C00
40 [
50 OPT PASS
60 PHA
70 CMP #58
80 BEQ COLON              check for colon
90 LDA #1
100 CMP &1E
110 BNE ITE               check for start of line
120 LDA #0                if not,jump to IF-THEN-ELSE check
130 STA &70               clear IF-THEN-ELSE indent
140 .ITE CPY #0
150 BNE WRITE             check decrunching counter for first character
160 LDA &37
170 CMP #&E7              load token value
180 BNE ELS               check for IF
190 INC &70
200 JMP WRITE             increment IF-ELSE indent counter
210 .ELS CMP #&8B
220 BNE WRITE             check for ELSE
230 INC &70
240 JSR SPACE             increment IF-ELSE indent counter
250 JSR A%                write spaces plus FOR-REPEAT-IF indenting
260 JMP WRITE             write extra space for ELSE
270 .SPACE LDA #10        write CR LF
280 JSR A%
290 LDA #13
300 JSR A%
310 CLC
320 LDA &3B
330 ADC &3C               load no. of FORs
                          add no. of REPEATs
340 ADC &70
350 TAX                   add no. of IFs and ELSEs
360 INX
370 LDA #32
380 JSR A%                write leading spaces
390 JSR A%
400 JSR A%
410 .LOOP JSR A%
420 JSR A%                write 2 spaces for each indent
430 DEX
440 BNE LOOP
450 RTS
460 .COLON JSR SPACE      write spaces plus FOR-REPEAT-IF indenting
470 .WRITE PLA            pull character from stack and write it
480 JMP A%
490 LDA #X%
500 STA V%                reset WRCHV to OS routine
510 LDA #Y%
520 STA V%+1
530 LDA #0
540 STA &1F               select LISTO 0
550 RTS
560 LDA #0
570 STA V%                set WRCHV to point to this routine
580 LDA #&C
590 STA V%+1
600 LDA #7
610 STA &1F               select LISTO 7
620 RTS:]
630 NEXT
640 *KEY0 ?&70=0:CALL&C6B|M
650 *KEY1 CALL&C5C|M
660 END
```

Listing 1.

MEGA MONSTERS

Tugomir Williams presents a hectic 32k game suitable for OS0.1and 1.2

HAVE you ever travelled through a time and space hole, and been confronted by fleets of Mega Monsters? No? Well here's your chance!

Mega Monsters is for a BBC model B and was written with a 0.1 MOS. It is a game in which you have to battle through four phases until the final confrontation with the Great Mega Monster!

The game is simple in concept, as are the controls (so if you're a vidiot who likes playing *Defender*, you will be lost for things to do).

First let's set the scene. Once upon a time (as you will be told in the instructions), you were flying in your Joy-ride space capsule, when you fell through a time and space hole. Then, when you regained your senses, Mega Monsters were hurtling towards you. Dodge them for about 30 seconds, picking up

```
   10 *KEY100.|MRUN|M
   20 DIMM$(3),D$(9)
   30 PROCset_up:MODE1:VDU23;8202;0;0;0:
PROCinstructions:MODE2:PROCarrival:MODE1
:SOUND&12,1,4,1:GOTO50
   40 PROCinstructions
   50 X%=RND(36):L%=3:B%=0:S%=0:TIME=0
   60 PROCphase_1:S%=S%+T%:IFCK=0 GOTO70
:ELSEL%=L%-1:IFL%>0 CLS:GOTO60:ELSE GOTO
120
   70 PROCphase_2:S%=S%+T%:IFCK=0 GOTO80
:ELSEL%=L%-1:IFL%>0 CLS:GOTO70:ELSE GOTO
120
   80 PROCphase_3:S%=S%+T%:IFCK=0 GOTO90
:ELSEL%=L%-1:IFL%>0 CLS:GOTO80:ELSE GOTO
120
   90 PROCphase_4:S%=S%+T%:IFCK=0 GOTO10
0:ELSEL%=L%-1:IFL%>0 CLS:GOTO90:ELSE GOT
O120
  100 PROCphase_5:S%=S%+T%:IFCK=0 GOTO11
0:ELSEL%=L%-1:IFL%>0 CLS:GOTO100:ELSE GO
TO120
  110 PROCfinish:GOTO60
  120 PROCend:GOTO40
  130 DEFPROCset_up:H%=0:H$="",
  140 ENVELOPE1,3,-2,1,1,1,1,1,100,-3,-2
,-1,126,100:ENVELOPE2,1,0,0,0,0,0,0,127,
-1,-1,-1,100,70:ENVELOPE3,1,2,-2,0,2,2,0
,90,-4,-4,0,90,10:ENVELOPE4,8,-2,1,1,2,1
,1,127,-1,-1,0,126,100
  150 VDU23,224,1,3,6,7,7,15,25,50,23,22
5,128,192,96,224,224,240,152,76,23,226,6
,15,24,48,24,12,6,15,23,227,0,189,231,66
,126,36,0,0,23,228,96,240,24,12,24,48,96
,240
  160 VDU23,229,15,16,31,17,16,33,32,115
,23,230,240,8,248,8,136,4,132,206,23,231
,0,231,231,231,0,126,126,126
  170 VDU23,232,0,224,224,224,0,126,126,
126,23,233,0,7,7,7,0,126,126,126,23,234,
23,34,144,245,144,54,45,32,23,235,128,64
,160,42,69,143,147,54
  180 VDU23,236,1,7,3,15,7,63,31,255,23,
237,128,224,192,240,224,252,248,255,23,2
38,255,255,255,255,255,255,255,255,23,23
9,255,31,63,7,15,3,7,1,23,240,255,248,25
2,224,240,192,224,128,23,241,0,24,60,60,
60,60,84,42
  190 B$=CHR$224+CHR$225+CHR$8:M$(1)=CHR
$226+CHR$227+CHR$228:M$(2)=M$(1):M$(3)=C
HR$229+CHR$230:W$=CHR$231:GL$=CHR$232:GR
$=CHR$233:EX$=CHR$234+CHR$235:BL$=CHR$24
1
  200 MO$=CHR$237+CHR$236+CHR$10+CHR$8+C
HR$8+CHR$238+CHR$238:A1$=CHR$236+CHR$238
+CHR$240:A2$=CHR$239+CHR$238+CHR$237
  210 D$(0"     TIME"
  220 D$(1)="      "+CHR$236+CHR$237+STRIN
G$(14," ")+CHR$236+CHR$237
  230 D$(2)="     "+CHR$236+STRING$(18,CHR
$238)+CHR$237
  240 D$(3)="   "+A1$+"      "+CHR$239+CHR$
238+CHR$240+"    "+CHR$239+CHR$238+CHR$240
+"      "+A2$
  250 D$(4)="   "+CHR$238+CHR$238+"
"+CHR$238+CHR$237+"   "+CHR$236+CHR$238+"
         "+CHR$238+CHR$238
  260 D$(5)="   "+A2$+STRING$(5," ")+CHR$
239+CHR$238+"   "+CHR$238+CHR$240+STRING$
(5," ")+A1$
  270 D$(6)="    "+A2$+"         "+CHR$239+"
"+CHR$240+"         "+A1$
  280 D$(7)="     "+A2$+"                "+A1
$
  290 D$(8)="    "+CHR$236+CHR$238+CHR$23
8+CHR$238+CHR$237+"              "+CHR$236+C
HR$238+CHR$238+CHR$238+CHR$237
  300 D$(9)=""
  310 ENDPROC
  320 DEFPROCphase_1:CLS:VDU19,1,1;0;19,
2,3;0;:N%=TIME
  330 IFTIME>N%+3000 T%=3000:CK=0:ENDPRO
C
  340 A%=RND(3):PROCmonster(RND(37),0,A%
,M$(A%)):Z%=(X%+1)*32:IFPOINT(Z%,56)=1 O
RPOINT(Z%,52)=1 ORPOINT(Z%,48)=1 ORPOINT
(Z%,56)=2 ORPOINT(Z%,52)=2 ORPOINT(Z%,48
)=2 T%=TIME-N%:PROCdeath(X%,0):CK=1:ENDP
ROC
  350 IFPOINT(Z%,33)=3 SOUND&12,1,50,10:
B%=B%+1
  360 PROCkey:GOTO330
  370 DEFPROCphase_2:R%=3:N%=TIME
  380 IFTIME>N%+3000 T%=3000:CK=0:ENDPRO
C
  390 CH=CH+1:IFCH>20 PROCwall(RND(20)+8
,RND(5)+4,1):CH=0:GOTO410
  400 A%=RND(R%):PROCmonster(RND(37),0,A
%,M$(A%)):IFTIME>N%+2700 R%=2:CH=0
  410 Z%=(X%+1)*32:IFPOINT(Z%,56)=1 ORPO
INT(Z%,52)=1 ORPOINT(Z%,48)=1 ORPOINT(Z%
,56)=2 ORPOINT(Z%,52)=2 ORPOINT(Z%,48)=2
 T%=TIME-N%:PROCdeath(X%,0):CK=1:ENDPROC
  420 IFPOINT(Z%,33)=3 SOUND&12,1,50,10:
B%=B%+1
  430 PROCkey:GOTO380
  440 DEFPROCphase_3:VDU19,1,4;0;19,2,6;
0;:G=10:C%=RND(20):N%=TIME
  450 W=RND(2):I%=RND(3)-2:C%=C%+I%:IFC%
>38-G C%=38-G:ELSE IF C%<2 C%=2
  460 IFG<=5 PRINTTAB(0,0)CHR$11TAB(X%,3
1)B$;:FORJ%=0TO2:PLOT69,RND(1280),1023:N
```



stranded mutants on the way to gain points and enter the next phase. Looming out of the distance, great Mega barriers appear, with only a small gap to get through. This continues for a further 30 seconds, all the while dodging Mega Monsters and picking up mutants.

Following that there is the great Mega tunnel, which leads to the heart of the Mega Monster civilization. You might think this is going to be a doddle, but you're wrong. The tunnel progressively gets narrower and narrower!

Once through the tunnel, you emerge into nice open space. But now you are confronted by more hordes of Mega Monsters (no friendly mutants here) and, to make things worse, the intense gravity makes your ship slow to respond.

If you stay calm and battle your way through them, you come face to face with the Great Mega Monster! You only have 30 seconds to kill it by firing into its only sensitive spot, the mouth. Your troubles are not over yet, because the Great Mega Monster has an annoying habit of closing its mouth. If by some freak of nature, you overcome this creature, bonus points are added to your score (depending on how long you've got left). So the sooner you kill it, the better.

If you manage this, you gain a new life and the nightmare begins again!

The score is calculated by adding the time you lasted (in one-hundredths of a second) to 100 times the number of mutants picked up, plus any bonus points from killing the Great Mega Monster.

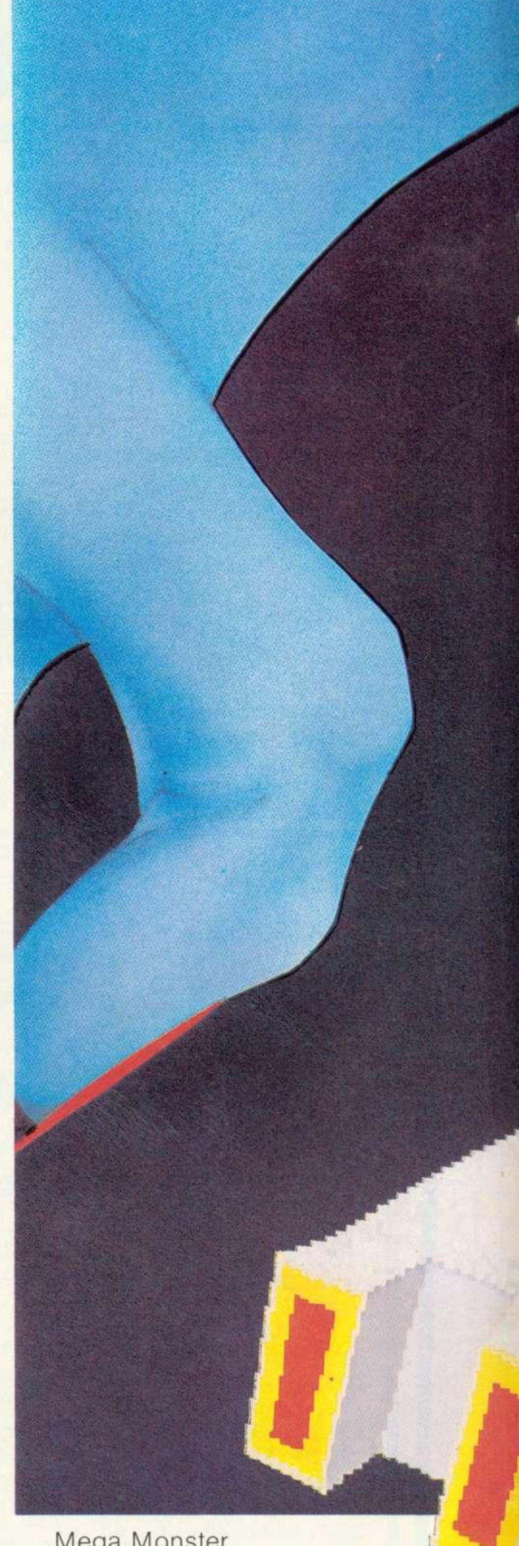
Now some notes on the program. The majority of lines are pretty long because memory is scarce, which also explains the lack of REMs (abbreviations may be helpful).

PROCEDURES

set-up, lines 130–310: sets envelopes, user definable graphics and strings.
phase–1, phase–2, phase–3, phase–4, and phase–5, lines 320–360, 370–430, 440–510, 520–570 and 580–760: these are the different phases of the game.
finish, line 770: this is called when you kill the Great Mega Monster. It prints your bonus and increments your lives.
arrival, lines 780–800: this is called when you first RUN the game. It uses mode 2 (16 colours), colour 0 for the background and colour 1 for titles etc. All the rest are set to black and a picture is generated (covered with some sound). When finished, it alternately makes each colour visible. (To represent you falling through a time and space hole.)
instructions, lines 810–840: prints the instructions.
death (X%,Y%), line 850: called when you die or kill the Great Mega Monster. It creates the explosion.
end, lines 860–910: prints 'Game Over' all over the screen, gives your score, previous hi-score etc, and ask for your name if its a high score.
wall (C%,G%,W%), line 920: prints a wall, with a gap G% wide, C% characters in from the left and in colour W%. It then scrolls the screen down.
Monster (C%,G%,M$), line 930: prints monster M$ (could be a Mega Monster or a mutant) at C% characters in, in colour G%. It also scrolls down the screen and prints your ship.
key, lines 940–950: reads the keyboard, alters your X co-ordinate and makes a sound for your ship. Phases 4 and 5 have their own routines.

VARIABLES

A%: used in phase–1, phase–2, and phase–4 for printing monsters etc.
A1$: used in 'set-up' in defining the Great Mega Monster.
A2$: same as A1$.
B%: bonus points gained.
B$: your ship.
BL$: your bullet (only used in phase–5).
C%: used in phase–3 for deciding where the gap in the wall will be.
CH: in phase–2 to determine when a wall should appear.
CK: check flag. It is set when leaving a phase to inform the main loop whether you have left due to getting killed or completing the phase.
D: used in phase–5 to read data for printing the Great Mega Monster.
D$(): dimensioned. Used in phase 5 and instructions to print the Great Mega Monster.
EX$: explosion, used in 'death', and phase–5 (when you hit the Great Mega Monster, but not in its mouth).
G%: used in 'wall' for the size of the gap in the wall, and in 'monster' for colour.
G: number of spaces in the gap in the wall, used in phase–2 and phase–3.
GL$: character to the left of the gap in the wall (used in 'wall').



GR$: character to the right of the gap (also used in 'wall').
H%: high score.
H$: name of person who got the high score.
I%: general dogs-body and loop variable.
I, I1, J%, K%: same as I%.
L%: number of lives left set in line 50 to 3. Cheats may like to alter this! It's also used in 'arrival' as a loop variable.
M$: used in 'monster' to define which one should be printed.
M$(): dimensioned. M$(1) & M$(2) are the ordinary Mega Monsters, and M$(3) is a mutant.
MO$: mouth of the Great Mega Monster, only used in phase 5.
N%: time at the start of a phase.
R%: used with A% in phase–2.
S%: score.
T%: total time lasted on the phase you are just leaving.
W: in phase–3, used to define the colour of a strip of wall.
W%: used in 'wall' for colour.
W$: the section of a wall.
X%: Your X co-ordinate.
XI: X increment used in phase–4, phase–5 and 'arrival'.
XB: X co-ordinate of bullet (only phase–5).
Y%: Y co-ordinate of bullet (phase–5).
YI: Y increment value, used in 'arrival'.
Z%: used to test if you've crashed (phases 1–4).



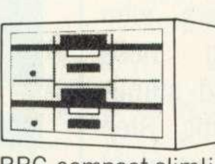
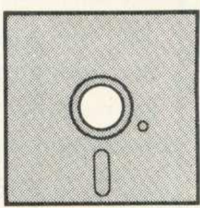
```
EXT:GOTO480
  470 PROCwall(C%,G,W)
  480 Z%=(X%+1)*32:IFPOINT(Z%-8,33)<>0 O
RPOINT(Z%+8,33)<>0 T%=TIME:PROCdeath(X%,
0):CK=1:ENDPROC
  490 G=G-.02:IFG<=4 CK=0:ENDPROC
  500 PROCkey:GOTO450
  510 GOTO460
  520 DEFPROCphase_4:VDU19,1,9;0;19,2,14
;0;:XI=0:X%=X%*32:N%=TIME
  530 GCOL0,3:FORJ%=0TO1:PLOT69,RND(1280
),1023:NEXT:A%=RND(2):C%=RND(38)-1:COLOU
RA%:PRINTTAB(C%,0)M$(A%):COLOUR3:PRINTTA
B(0,0)CHR$11:VDU5:MOVEX%,32:PRINTB$;:VDU
4:SOUND&11,-10,C%,1
  540 Z%=X%+32:IFPOINT(Z%,56)<>0 ORPOINT
(Z%,52)<>0 ORPOINT(Z%,48)<>0 T%=TIME-N%:
X%=X%DIV32:PROCdeath(X%,0):CK=1:ENDPROC
  550 IFTIME>N%+3000 T%=3000:CK=0:ENDPRO
C
  560 XI=XI-INKEY(-122)*8+INKEY(-26)*8:S
OUND&13,2,X% DIV5,1:X%=X%+XI:IFX%>1180 X
%=1180:XI=0:ELSE IFX%<0 X%=0:XI=0
  570 XI=XI/1.1:GOTO530
  580 DEFPROCphase_5:RESTORE760:VDU19,2,
4;0;19,1,1;0;:SOUND&10,-15,7,255:IF CK=1
 XI=0
  590 READD:COLOUR2:PRINTTAB(8,0)D$(D)TA
B(0,0)CHR$11:COLOUR3:SOUND&11,-15,D*8,5:
SOUND&12,-15,D*8+14,5:SOUND&13,-15,D*8+2
8,5:VDU5:MOVEX%,32:PRINTB$;:VDU4:SOUND&1
1,-15,255,5:IFD=0 GOTO650
  600 Z%=X%+32:IFPOINT(Z%,56)<>0:T%=TIME
-N%:PROCdeath(X%DIV32,0):CK=1:ENDPROC
  610 IFINKEY(-122) XI=XI+8:SOUND&13,2,X
% DIV5,1
  620 IFINKEY(-26) XI=XI-8:SOUND&13,3,X%
 DIV5,i
  630 X%=X%+XI:IFX%>1180 X%=1180:XI=0:EL
SE IFX%<0 X%=0:XI=0
  640 XI=XI/1.1:GOTO590
  650 SOUND&11,0,0,0:SOUND&13,0,0,0:SOUN
D&10,0,0,0:GCOL0,1:PRINTTAB(20,5);"<>"
  660 XB=X%:W%=X%:Y%=0:TIME=0:VDU5
  670 XI=XI-8*INKEY(-122)+8*INKEY(-26):S
OUND&13,-10,X%DIV5,3
  680 IFINKEY(-99)ANDY%=0 Y%=64:XB=X%+16
:GCOL0,1:MOVEXB,Y%:PRINTBL$
  690 X%=X%+XI:IFX%>1180 X%=1180:XI=0:EL
SE IFX%<0 X%=0:XI=0
  700 XI=XI/1.1:GCOL3,3:MOVEW%,32:PRINTB
$:MOVEX%,32:PRINTB$:W%=X%
  710 IF Y%<>0 GCOL3,1:MOVEXB,Y%:PRINTBL
$:Y%=Y%+32:MOVEXB,Y%:PRINTBL$:IFPOINT(XB
,Y%+32)<>0 ORPOINT(XB+32,Y%+32)<>0 MOVEX
B,Y%:PRINTBL$:MOVEXB-16,Y%+32:PRINTEX$:S
OUND&10,2,6,3:MOVEXB-16,Y%+32:PRINTEX$:Y
%=0
  720 IFY%>790 ANDXB>630 AND XB<700 T%=3
000-TIME:MOVEXB,Y%:PRINTBL$:PROCdeath(20
,840):CK=0:ENDPROC
  730 VDU4:COLOUR3:PRINTTAB(26,1);(3000-
TIME)DIV100"  ":IF TIME>3000 PRINTTAB(26
,1)"0  ":T%=0:PROCdeath(X%DIV32,0):CK=1:
ENDPROC:ELSE VDU5
  740 IFRND(10)=1 GCOL3,2:MOVE640,789:PR
INTMO$
  750 GOTO670
  760 DATA9,9,9,9,9,9,9,9,9,9,9,9,9,9,9,
9,9,9,9,9,9,9,8,7,6,5,4,3,2,1,9,0
  770 DEFPROCfinish:COLOUR1:PRINTTAB(18,
12)"BONUS":FORI%=0TO255STEP5:VDU19,2,RND
(7);0;:FORJ%=0TO15:SOUND(J%MOD3+17),-J%,
T%,5:NEXT:PRINTTAB(18,13);T%*I%DIV50:NEX
T:X%=X%DIV32:S%=S%+T%*I%DIV50:L%=L%+1:EN
DPROC
  780 DEFPROCarrival:VDU23;8202;0;0;0;:S
OUND&10,4,7,255:COLOUR1:PRINTTAB(3,26)"(
c) Acorn User"TAB(3,28)"September 1983":
PRINTTAB(3,11)"Mega Monsters"TAB(9,16)"b
y"TAB(2,21)"Tugomir Williams":FORI%=2TO1
5:VDU19,I%,0;0;:NEXT:I%=2
  790 XI=RND(1)*10-5:YI=RND(1)*10-5:X%=6
40+XI*15:Y%=512+YI*15:FORJ%=I%TOI%+30:GC
OL0,J%MOD14+2:PLOT69,X%,Y%:X%=X%+XI:Y%=Y
%+YI:XI=XI*1.1:YI=YI*1.1:NEXT:I%=I%+1:IF
I%<20 GOTO790
  800 SOUND&10,-15,7,255:I%=0:J%=0:COLOU
R1:PRINTTAB(3,11)"Mega Monsters"TAB(9,16
)"by"TAB(2,21)"Tugomir Williams":FORK%=0
TO255:SOUND&11,0,K%,5:I%=I%+1
  810   FORL%=0TO300-K%:NEXT:VDU19,J%MOD
14+2,0;0;19,I%MOD14+2,6;0;19,1,(I%DIV6)M
OD6+1;0;:J%=I%:NEXT:FORI%=2TO15:VDU19,I%
,6;0;:FORJ%=1TO40:SOUND&11,4,I%*J%,1:NEX
T:NEXT:SOUND&10,1,7,10:SOUND&11,0,0,0:EN
DPROC
  820 DEFPROCinstructions:PRINT:CLS:COLO
UR2:FORI%=1TO9:PRINTTAB(8,I%)D$(I%):NEXT
:COLOUR3
  830 PRINT'" Once upon a time you were
flying your"'"Joy-ride space capsule, wh
en you fell"'"through a space and time h
ole."'"You found yourself near a Mega-pl
anet"'"full of Mega-monsters ";(M$(2));"
."
  840 PRINT''" Your only hope is to avoi
d them,using"'"the left and right arrow
keys, and"'"when you come face to face w
ith the"'"Great Mega-Monster, you have t
o kill it"'"within 30 seconds. To fire u
se the"'"space bar."
  850 PRINT''" If you pick up a stranded
 mutant ("M$(3)")"'"you gain 100 bonus p
oints."''"Press <RETURN> to continue.":R
EPEAT A%=INKEY(100):VDU19,2,RND(7);0;:UN
TIL A%=13:ENDPROC
  860 DEFPROCdeath(X%,Y%):SOUND&13,0,0,0
:GCOL3,3:SOUND&10,-15,7,40:SOUND&11,0,10
0,40:VDU5:FORI=1TO15STEP.4:FORI1=1TOI DI
V4:MOVE(X%+1)*30+RND(I*20)-I*10,Y%+RND(I
*10):PRINTEX$:NEXT:NEXT:VDU4:ENDPROC
  870 DEFPROCend
  880 VDU5:SOUND&10,-15,7,255:FORI=0TO2*
PI STEPPI/15:GCOL0,(I MOD 3)+1:SOUND&11,
0,I*40.6,3:MOVE500+400*COS(I),512+300*SI
N(I):PRINT"Game Over":NEXT:SOUND&10,0,0,
0:VDU4
  890 CLS:S%=S%+B%*100:PRINTTAB(10,5)"Sc
ore    :";S%TAB(10,7)"Hi-Score :";H%TAB(
10,9)"Scored by "H$TAB(0,11)"You picked
up "B%" stranded mutant";:IFB%=1 PRINT".
" ELSEPRINT"s."
  900 *FX15,1
  910 IFS%>H% H%=S%:PRINTTAB(10,13)"You
have a Hi-Score":INPUTTAB(0,15)"Enter yo
ur name "H$:ELSEPRINTTAB(10,20)"Press <R
ETURN> to continue":REPEATA=GET:UNTILA=1
3
  920 ENDPROC
  930 DEFPROCwall(C%,G%,W%):COLOURW%:PRI
NTTAB(0,0)STRING$(C%,W$)GL$SPC(G%)GR$STR
ING$(40-POS,W$):COLOUR3:PRINTTAB(0,0)CHR
$11TAB(X%,31)B$;:SOUND&10,1,6,1:ENDPROC
  940 DEFPROCmonster(C,Y,G,M$):COLOURG:P
RINTTAB(C,Y)M$:COLOUR3:PRINTTAB(0,0)CHR$
11TAB(X%,31)B$;:SOUND&11,-10,C,3:ENDPROC
  950 DEFPROCkey:Z%=X%:X%=X%-(INKEY(-122
)ANDX%<37)+(INKEY(-26)ANDX%>0):IFZ%<>X%
SOUND&13,2,X%*6,1
  960 ENDPROC
```

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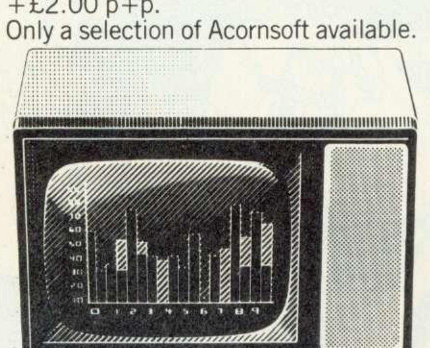
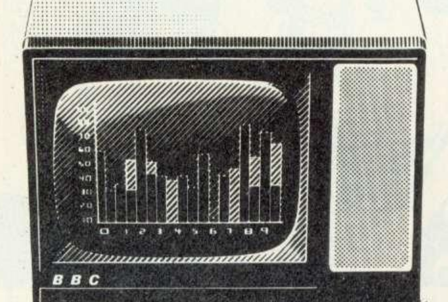
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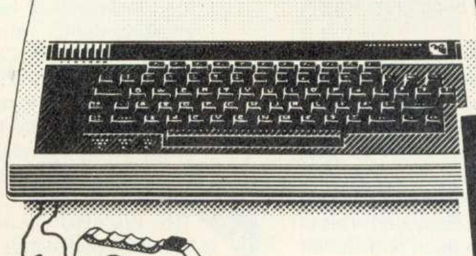
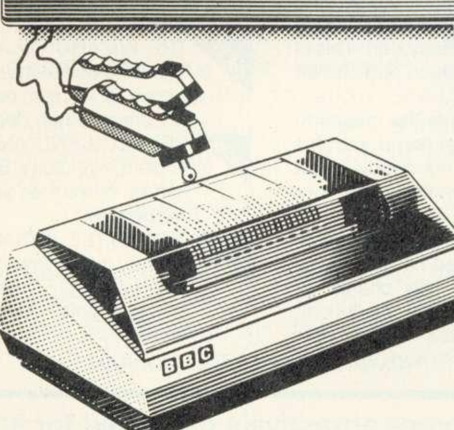
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George Hill adds a dose of assembler to speed up graphics dumps

INJECTING A BIT OF PACE

ALL THE dump programs so far in this series have been written in Basic which has to be 'interpreted'. This means each instruction has to be translated into machine code *every time* it is encountered. If we can do some of the translation for the machine *once* at the beginning by writing the core of the program in assembly language it will run much faster.

Theoretically, the more we translate into assembly language, and hence into machine code, the faster the dump; but there are limitations. First, inefficient assembly language could conceivably be slower than Basic, and second the printer has a maximum speed.

Program 1 illustrates the second limitation for the Seikosha AP100A. The BBC sends out bands of dots as fast as it can, but the printer cannot keep up because of its limited buffer size. The buffer on a printer stores characters until it is full, or until it receives a 'print' instruction, such as <RETURN> (code 13). The flow of characters from the computer is then interrupted (by the busy signal normally) while printing takes place. If the buffer contains less than one lineful of characters, it is normal for the printhead to return to the beginning of the line, and then back to the 'printing-point' before more characters are printed. This is a slow process, and to avoid it the buffer size must equal or exceed the number of codes necessary to cause the printing of a full line. The Seikosha buffer is only 90 characters, fine for letters or numbers, but only a sixth of a line of graphics characters. The Epson MX80F/T can print 960 graphics characters per line, so needs at least a 1k buffer to allow rapid graphics printing. The serial interface board has a 2k buffer for just this purpose.

read pixel
Adjust byte and rotate it to left
Is byte completed?
N
Adjust X (or Y)
Y
Send byte to printer

Figure 1. Preparing one byte

This means that, for the Epson, the program must be capable of keeping the buffer topped up by sending a thousand or more characters during the carriage return pause. Hence the necessity for high baud rates in serial for graphics dumps. The Epson has a peculiarity in that 9600 baud seems not to work. The reason is that two stop-bits are needed at this baud rate, and the BBC micro only supplies one. There is a *FX call to change this, and a data sheet on it is available from Acorn. The call is *FX156,16,227.

Used in conjunction with *FX8,7 and either *FX5,2 or *FX3,1 the Epson should now operate normally at 9600 baud.

To test your printer's maximum speed, you should construct a suitable program on the lines of program 1, changing the control characters as necessary.

Most assembly language programs printed here are written for legibility rather than speed, and employ subroutines called by the jsr instruction. (This has disadvantages which will be elaborated upon at a later date.)

They use operating system calls, so should work through the Tube and with any version of the operating system.

The conventions of X or X% for X co-ordinate; Y or Y% for Y coordinate; byte – the byte being prepared to go to the printer; are used in this article.

The section of code in a dump carried out most often is the preparation of the printer byte. This is best represented by a flow diagram (figure 1). To carry this out in machine code we need to write assembly language to carry out five operations:

```
10.REM SEIKOSHA BUFFER TEST
20 VDU2,1,10,1,8
30 PROCASS
40 CALL bars
50 VDU1,15,3
60 END
70 DEFPROCASS
80 oswrch=&FFEE
90 DIM bars 20
100 P%=bars
110 [OPT 2
120 .bars
130 .outer_loop        ldx #&6
                       ldy #&FF
140 .inner_loop        lda #1
150                    jsr oswrch
160                    lda #&FF
170                    jsr oswrch
180                    dey
190                    bne inner_loop
200                    dex
210                    bne outer_loop
220                    rts
230 ]
240 ENDPROC
```

Program 1. Seikosha AP100 buffer test



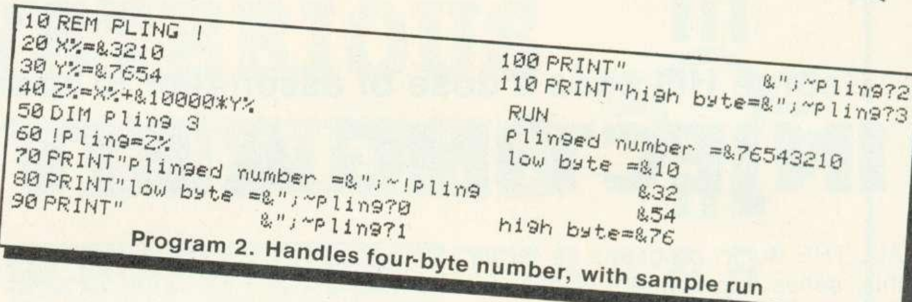
- read a pixel – the equivalent of POINT(X,Y) in Basic.
- adjust byte by rotating it and making the necessary changes.
- run and check a counter to find out when the byte is complete.
- increment or decrement the value of X and/or Y – the equivalent of the x or y loops in Basic dumps.
- send the byte to the printer via VDU 1.

In addition, we must be able to set up space for the assembled program, and its attendant variables. Finally, we shall assemble the program in its reserved space, and CALL it from Basic as required. I have placed all variables first in the assembled code, followed by the sub-routines, and ending with the controlling program. This will cause some problems when we want to write re-locatable code, but makes programs more legible.

The most complex subroutine is the OSWORD equivalent of POINT. The *User Guide* explanation (page 458) is accurate, but brief. The call which interests us is the one with the accumulator containing 9 (page 462). A block of five bytes must be defined. The first four are for the X and Y coordinates (two bytes each), and the fifth is for OSWORD to put the result into.

The five bytes are defined as follows:

Xlo contains the low byte of the X coordinate;
Xhi contains the high byte of the X coordinate;
Ylo contains the low byte of the Y coordinate;
Yhi contains the high byte of the Y coordinate;
value is the space for the result of POINT (X,Y).



```
10 REM PLING !
20 X%=&3210
30 Y%=&7654
40 Z%=X%+&10000*Y%
50 DIM Pling 3
60 !Pling=Z%
70 PRINT"Plinged number =&";~!Pling
80 PRINT"low byte =&";~Pling?0
90 PRINT"          &";~Pling?1
100 PRINT"          &";~Pling?2
110 PRINT"high byte=&";~Pling?3
RUN
Plinged number =&76543210
low byte =&10
          &32
          &54
high byte=&76
```

Program 2. Handles four-byte number, with sample run

The routine first puts the values of X and Y, split into high and low bytes, into Xlo to Yhi, and loads the accumulator with 9. Next it loads the X register with the low byte of the address of Xlo (Xlo MOD 256) and loads the Y register with the high byte of the address of Xlo (Xlo DIV 256).

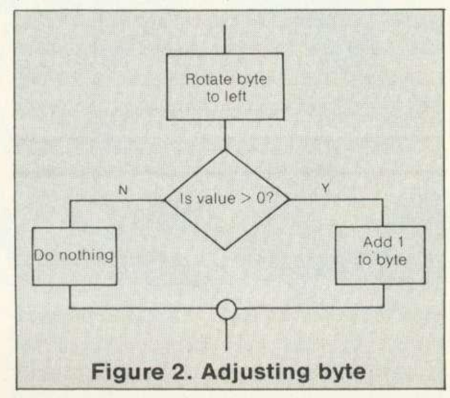


Figure 2. Adjusting byte

Then it jumps to the OSWORD routine located at $FFF1. The routine returns with the colour of the pixel deposited in 'value'.

The assembly language for the subroutine is

```
.point lda #9
ldx #Xlo MOD 256
ldy #Xlo DIV 256
jsr osword
rts
```

All that remains is to get the values of X and Y into the four locations Xlo to Yhi. The number X% + &10000*Y% consists of four bytes. The bottom two are the value of X%, and the top two the value of Y%.

The result can be stored in four successive bytes by the ! (pling) command (*User Guide*, page 410). The explanation is again brief, and program 2 illustrates the process of preparing, storing and retrieving a four-byte number in Basic. All numbers are in hexadecimal.

For the printer program, the necessary numbers are generated and stored by the line

!Xl o=%+&10000*Y%

Now for the adjustment and calculation of byte. For a simple on/off dump the requirements are as in figure 2. There are two methods of rotating a number; arithmetic shift, and rotate. The difference is in the way they deal with the 'carry-bit'. Figure 3 illustrates the difference. The final contents of the least significant bit (lsb) of byte is always 0 for the asl (arithmetic shift left). For rol (rotate left) the lsb depends on the initial contents of the carry bit. This can be set and cleared by the instructions sec (set carry bit) and clc (clear carry bit).

Figure 2 translates into the code:

```
asl byte        /shift byte left, putting
                /0 into lsb
lda value
beq go_on       /if value = 0 jump to
                /next instruction
inc byte        /otherwise add 1 to byte
.go_on next instruction.
```

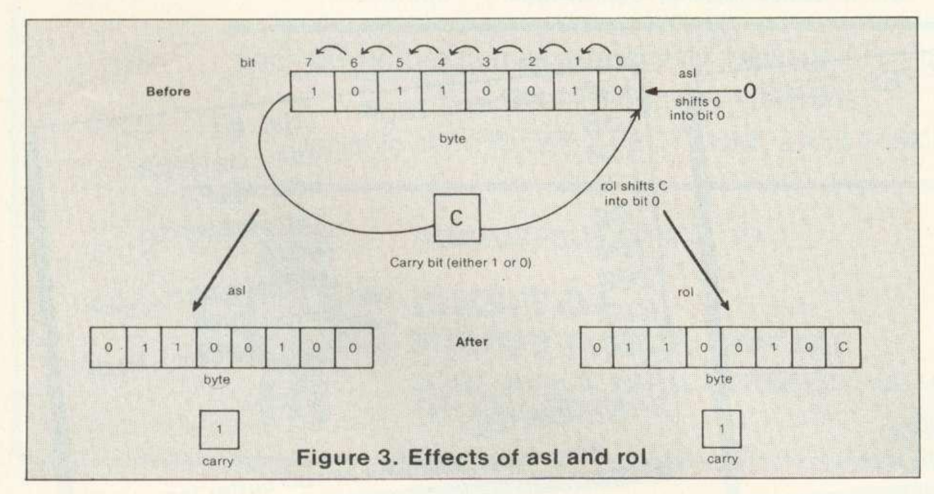


Figure 3. Effects of asl and rol

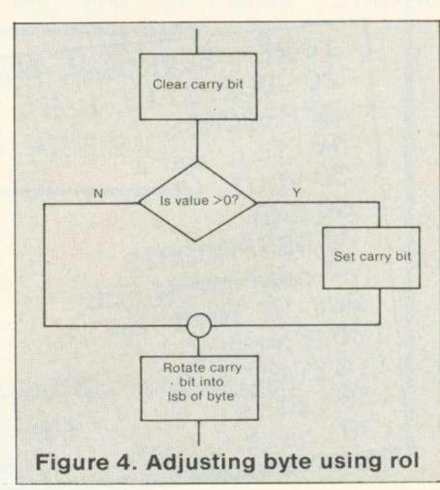


Figure 4. Adjusting byte using rol

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There is another way of accomplishing the same end, which will generalise more easily when we come to pattern dumps. The carry bit may be used as a temporary home for the next bit to go into byte. Figure 4 shows the flow diagram. The coding is:

```
clc            /clear the carry bit
lda value
beq go_on/rotate the 0 from clc into
               byte
               /if value=0
sec            /set the carry for rotation
               into byte
               /if value <>0
.go_on rol byte
```

Next we come to dealing with a counter. The counter will be set in the Basic section of the program by a 'poke'. For example if seven bits need rotating into byte, we can use:

```
?count_7=7
```

to set the counter, and the lines:

```
dec count_7
bne loop_start
```

will cause repetition of the loop starting at label .loop_start seven times.

Arithmetic on the 6502 microprocessor is eight-bit arithmetic. If there are 'borrows' or 'carries' they

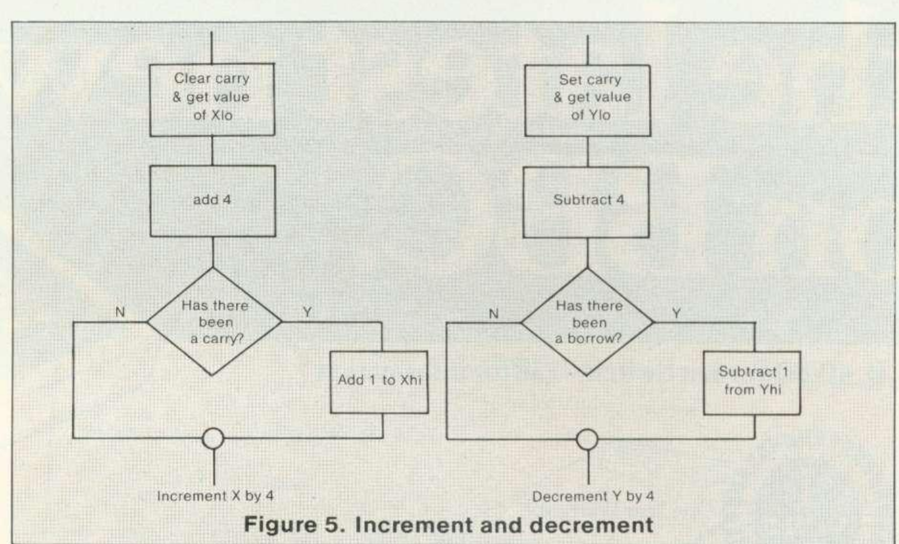
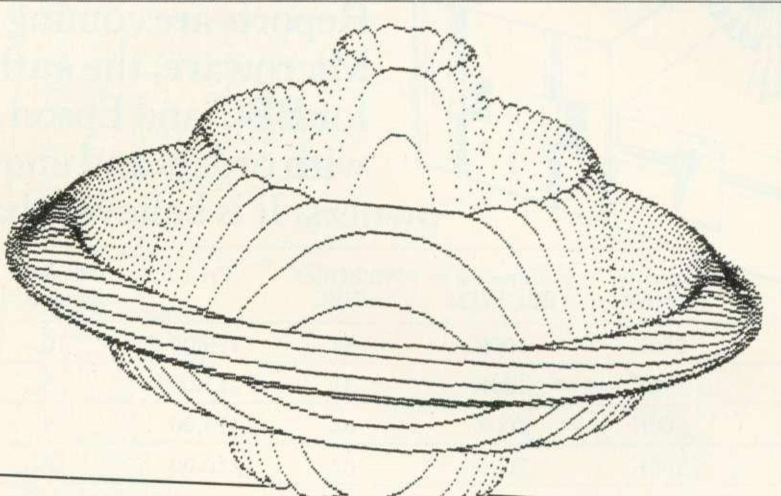


Figure 5. Increment and decrement

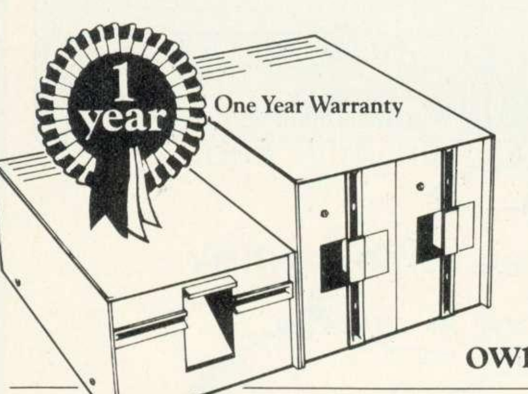


```
10 REM *** SKASS ***
20 REM Hybrid basic/assembler Program to dump screen
30 REM on the SEIKOSHA AP100A Printer
40 REM G.B.Hill April 1983
50 REM PROGRAM START
60 PROCASSEMBLE
70 REM call Printer
80 *FX5,1
90 REM enable Printer, and switch to graphics mode
100 VDU2,1,8
110 REM clear PaPer
120 VDU1,10,1,10,1,10
130 FOR Y%=996 TO -12 STEP -28
140 FOR X%=0 TO 1279 STEP 4
150 !Xlo=X%+Y%*&10000
160 ?count_7=7
170 CALL one_byte
180 NEXT
190 VDU1,10
200 NEXT
210 REM switch off graphics mode and disable Printer
220 VDU1,15,3
230 END
240 DEFPROCASSEMBLE
250 osword=&FFF1
260 oswrch=&FFEE
270 DIM S% 80
280 Xlo=S%
290 Xhi=S%+1
300 Ylo=S%+2
310 Yhi=S%+3
320 value=S%+4
330 byte=S%+5
340 count_7=S%+6
350 S%=S%+7
360 FOR oPt=0 TO 2 STEP 2
370 P%=S%
380 [OPT oPt
390 \ subroutine to evaluate POINT(X,Y)
400 .Point       lda #9
410              ldx #Xlo MOD 256
420              ldy #Xlo DIV 256
430              jsr osword
440              rts
450 \ subroutine to Print a byte
460 .Printchar   lda #1
470              jsr oswrch
480              lda byte
490              jsr oswrch
500              rts
510 \subroutine to increment Y by 4
520 .incY        clc
530              lda Ylo
540              adc #4
550              sta Ylo
560              bcs inc_Yhi
570              rts
580 .inc_Yhi     inc Yhi
590              rts
600 \main Program
610 .one_byte    lda #1
620              sta byte
630 .loop        asl byte
640              jsr Point
650              lda value
660              beq go_on \do nothing if colour is zero
670              eor #&FF
680              beq go_on \or if Point is off screen
690              inc byte
700 .go_on       jsr incY
710              dec count_7
720              bne loop
730              jsr Printchar
740              rts
750 ]
760 NEXT oPt
770 ENDPROC
```

Program 3. Listing (printed out by Seikosha) of Basic/assembler dump for AP100 with graphics example (took 4½ minutes)

Microware presents the latest news on BBC.

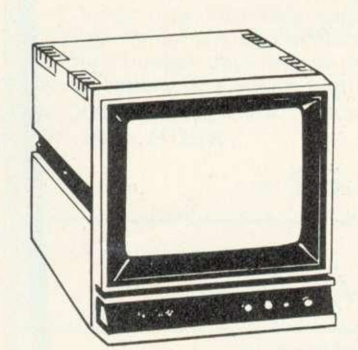
N.B. 40/80 Format Switch – call for information



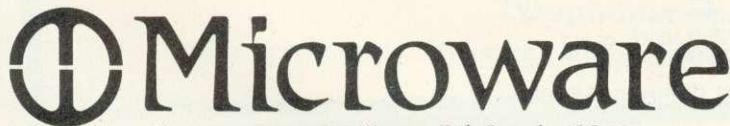
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ZL292	2Mb	800K	124	575.00	5

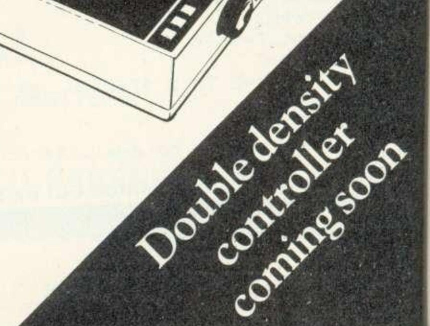
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Further news items, of interest to BBC micro users, are the Hantarex monochrome monitors with green or amber screen options. A full range of Epson printers are available from stock, including the RX 80 at £295 and the FX 80 and MX 100. High quality Dysan and Memorex floppy diskettes start at £1.62 and are always available.



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must be taken care of in the code. We shall want mainly to increment or decrement X and Y by 4. The flow diagrams are in figure 5. The codings for the subroutines are:

```
.incY4   clc
         lda Ylo
         adc #4
         bcs incYhi
         /increment high byte if there
         /has been a carry
rts      /otherwise return
.incYhi  inc Yhi
         rts
.decX4   sec
         lda Xlo
         sbc #4
         bcc decXhi/decrement Xhi
         /only if a borrow
         /has occurred
rts      /otherwise return
.decYhi  dec Yhi
         rts
```

X and Y can be incremented and decremented by any value using variations of these routines. The odd coding is faster than the standard automatic-carry method of addition as nothing is done if there is no carry.

VDUn is accomplished by loading the accumulator with n, and then jumping to the OS routine OSWRCH at &FFEE. To send a byte to the printer only, the code is:

```
.printchar lda # 1
           jsr oswrch
           lda byte
           jsr oswrch
```

So there it is. All that remains is to put everything together for a particular printer.

Programs 3 and 4 illustrate the process for a simple on/off dump for the Seikosha and Epson printers. When either is run, PROCASSEMBLE is called first. In this, oswrch and osword are defined. Space is reserved for variables and the assembled routine by a DIM statement. The variables are defined with reference to the start of the reserved area of memory. The variable S% keeps track of the current address. The routine is assembled in two passes, starting each pass with P% set to the current value of S% (immediately after the variables). The controlling program is as explained above, calling its various subroutines in turn.

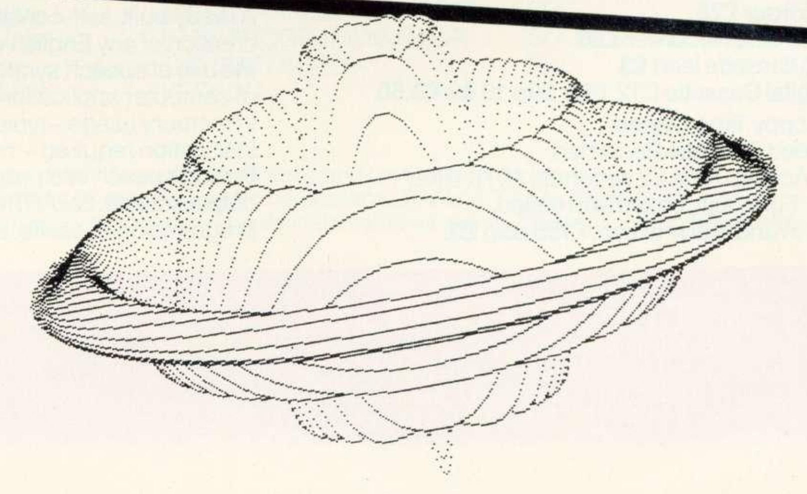
The exceptions are that in the Seikosha dump 'byte' is set to 1 (lda #1:sta byte) at the start of each CALL. The 1 will end up after seven rotations in the most significant bit (msb) which has to be set for all graphics characters on the Seikosha. Also lines 670 and 680 avoid a black line being printed at the bottom of the picture. This is caused by OSWROD returning –1 for points off the screen.

The Basic program now takes over, scanning the screen as usual. But in place of the y% loop, and its contents, we set the values of Xlo to Yhi, reset the counter, and CALL one_byte. The routine calculates and prints a byte, and the process is repeated until the scan is complete.

The increase in speed is very marked, and in fact gets up to the maximum for the Seikosha. The dumps are more than twice as fast as their Basic equivalents.

```
10 REM *** EPSASS ***
20 REM Hybrid basic/assembler program to dump screen
30 REM on the EPSON MX80 FT printer
40 REM G.B.Hill (c) April 1983
50 REM PROGRAM START
60 PROCASSEMBLE
70 REM call printer
80 *FX5,1
90 REM enable printer, and set linefeed with ESC A 8
100 VDU2,1,27,1,65,1,8
110 REM clear paper
120 VDU1,10,1,10,1,10
130 FOR Y%=1023 TO 0 STEP -32
140 REM send bit code;  ESC K 64 1 ;320 dots per line
150 VDU1,27,1,75,1,64,1,1
160 FOR X%=0 TO 1279 STEP 4
170 !Xlo=X%+Y%*&10000
180 ?count_8=8
190 CALLone_byte
200 NEXT
210 VDU1,10
220 NEXT
230 REM send formfeed and disable printer
240 VDU1,12,3
250 END
260 DEFPROCASSEMBLE
270 osword=&FFF1
280 oswrch=&FFEE
290 DIM S% 80
300 Xlo=S%
310 Xhi=S%+1
320 Ylo=S%+2
330 Yhi=S%+3
340 value=S%+4
350 byte=S%+5
360 count_8=S%+6
370 S%=S%+7
380 FOR opt=0 TO 2 STEP 2
390 P%=S%
400 [OPT opt
410 \ subroutine to evaluate POINT(X,Y)
420 .point          lda #9
430                 ldx #Xlo MOD 256
440                 ldy #Xlo DIV 256
450                 jsr osword
460                 rts
470 \ subroutine to print a byte
480 .printchar lda #1
490                 jsr oswrch
500                 lda byte
510                 jsr oswrch
520                 rts
530 \subroutine to
    decrement Y by 4
540 .decY           sec
550                 lda Ylo
560                 sbc #4
570                 sta Ylo
580                 bcc dec_Yhi
590                 rts
600 .dec_Yhi        dec Yhi
610                 rts
620 \main program
630 .one_byte       jsr point
640                 clc
650                 lda value
660                 beq go_on
670                 sec
680 .go_on          rol byte
690                 jsr decY
700                 dec count_8
710                 bne one_byte
720                 jsr printchar
730                 rts
740 ]
750 NEXT opt
760 ENDPROC
```

Program 4. Epson-printed listing of MX80 hybrid dump (example took 2½ minutes)



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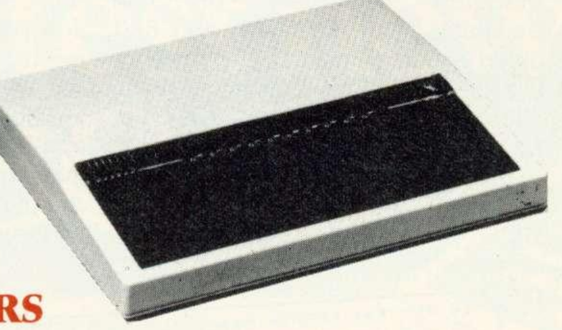
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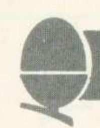
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Barry Pickles hosts a new cash-for-tips column. Here's a chance to show off your talents – and earn some crinkly green stuff into the bargain. There are reckoned to be some 40,000 of you out there and, bearing in mind that the Atom has been around for more than two years, you must have accumulated a fair amount of expertise.

What we're looking for are those little routines, tips and hardware mods you've discovered. Don't worry if your little wrinkle seems too simple – it's probably just what someone else has been looking for. The same rules apply here as in Ian Birnbaum's **Beeb Forum.** Short, sweet and as original as possible is the name of the game. I'll start you off, but this is **your** page, so let's hear from you!

Send your ideas to Atom Forum, Acorn User, 53 Bedford Square, London WC1B 3DZ. If you want it returned, enclose a SAE. It should be typed or printed, with programs on cassette (with listing if possible).

SEVEN TOOL BOX ROUTINES TO TYPE IN

LOTS of goodies this month for readers who don't own any of the 5000 'toolbox' ROMS sold. Listings 1 to 6 are self-contained programs, but numbered so you can use them as a complete suite. Those which contain machine code all assemble to #21C, which is free space. They may, however, be reassembled anywhere, by altering the initial value of P (the location counter). All branches are relative, so the routines will reassemble correctly.

Listing 1 provides automatic line numbering and is transparant to the user. It assumes you wish to write a program in the lower text space, so it must reside in the upper area. After the initial prompts, line numbers will be issued each time you press return. To quit, press return immediately after a new line number appears. This will put you in the lower text space and set TOP.

It works using a counter (M) to point to the next free memory location. Starting at line 100, a loop is set up with the first two bytes set to the value of the next line number (N). The program text is input as a string, after first pointing A to M (line 110). Line 120 checks for a null string (ie, a carriage return) and calls subroutine a, if it finds one.

Line 130 stores the individual characters of $A from M onwards, then increments M and N (line 140). Before looping back, checks are made to ensure there's enough memory and that the next line number will not exceed the bounds allowed on the Atom. If either test succeeds, the program exits by calling subroutine a. This sets the next byte to #FF (so the Atom can recognise the end of the program), jumps to the lower text space and sets TOP.

The only thing we haven't covered is line 30. This stores #FF in all bytes of the lower text area, so line 150 can check whether you are running out of memory by 'looking ahead' 32 bytes. If there is no RAM, it won't find #FF stored!

The counterpart to this program, renumber, is given in the Atom manual (page 136).

Listing 2 sets all integer variables to zero – a good thing to do at the start of any program. The variables are stored in the 108 bytes beginning #321 and the program is a simple loop to store 0

Listing 1.

```
10   REM: Autonumber
20   P.$12"PLEASE WAIT A MOMENT"'
30   F.C=#2903 TO #3C00 S.4; !C=#FFFFFFFF;N.
40   M=#2901; @=1
50   IN."FIRST LINE NO: "N
60   IFN< 0 ORN > 32760 P.$7"OUT OF RANGE!"'; G.50
70   IN."STEP: "S
80   IFS <1 ORS > 16000 P.$7"DON'T BE SILLY!!"'; G.70
100  DO; ?M=N/256; M?1=N%256
110  P.N; M=M+2; A=M; IN.$A
120  IF?A=13 M=M-2; GOS.a; E.
130  F.T=0 TO LENA; M?T=A?T; N.
140  M=M+LENA+1; N=N+S
150  IF M?32 <> #FF P.$7"NO MORE MEMORY"'; GOS.a; E.
160  U.N>=32760; P.$7"NO MORE LINE NUMBERS'; GOS.a; E.
170a ?M=#FF; ?18=#29; !TOP=M+1; R.
```

Listing 2.

```
200  REM: Zero variables
210  P=#21C; P.$21; [
220  LDA@0; TAX; STA#321,X; INX
230  CPX@108; BNE P-6; RTS: ]
240  P.$6; LI.#21C; E.
```

Listing 3.

```
300  REM: Variable dump
310  @=1; P=#21C; P.$21; [
320  LDA@65; LDY@1
330  STA#80; STY#81; JSR#FE52
340  LDA@CH"="; JSR#FE52; LDX@1
350  JSR#C8E3; JSR#C589; JSR#FFED
360  INC#80; LDA#80; LDY#81; INY
370  CPY@27; BNE P-30; RTS; ]
380  P.$6; LI.#21C; E.
```

Listing 4.

```
400  REM: Block move
410  P.$12; IN."BLOCK START ADDRESS"S
420  IN."BLOCK END ADDRESS"E
430  IF E-S < 1 P.$7"DON'T BE SILLY!"'; G.420
440  IN."MOVE TO ADDRESS"D
450  IF D+(E-S) > #9800 P.$7"CAN'T WRITE
     TO ROM!"'; G.440
460  F.N=S TO E S.4; !D=!N
470  D=D+4; N.; E.
```



Listing 5.

```
600   REM: Visible loading
610   P=#21C; M=P; P.$21; [
620   JSR#FBEE; STA#801F
630   STA#B002; RTS; ]; P.$6
640   ?#214=M%256; ?#215=M/256; E.
```

Listing 6.

```
700   REM: Splits multi-statement lines
710   REM: Suggested by program in Acorn User June '83
710   P=#21C; M=P; P.$21; [
720   STY#80; LDY#32D; CPY@0
725   BPL P+23; LDY#80
730   CMP@59; BNE P+17; JSR#FFED
740   LDX@4; LDA@32; JSR#FE52
750   DEX: BNE P-6; LDA@59
760   LDY#80; JSR#FE52; RTS; ]; P.$6
770   ?#208=M%256; ?#209=M/256; E.
```

Listing 7.

```
5     REM: Auto list on error
10    A=#2880; ?16=A/256; ?17=A/256
20    $A="B=?1+256*?2; ?#80=?0; G.q"
30    REM: insert your program from here onwards
      ..............
      ..............
9000  E.
9010q P.$6$7$15 ' ' "ERROR "?#80'
9020  P."LINE "B ' '; $A="LIST          "
9030  C=LENA-1; DO
9040  A?C=B%10+48; B=B/10; C=C-1
9050  U.B=0; ZZZZZ
```

in all these locations. Note that variable P will *not* be zeroed, since it is used by the routine.

This might be a good place to explain variable storage. The value of any integer variable is stored in four bytes, least significant byte (LSB) first, beginnng at #321 (variable @). However, the next byte of the variable is stored 27 bytes further on, and the next byte 27 bytes further on still and so on. Thus, variable @ is stored in #321 (LSB), #33C, #357, #372(MSB). A similar situation exists with arrays, except only two bytes are used for each and these store the *address* of the *start* of that set of arrays, ie they point to the start of storage for element 0. Again, storage is LSB first and begins at #2EB (array @@), with the MSB stored 27 bytes later.

Listing 3 prints the current value of all integer variables. Four operating system routines are called. The one at #FE52 prints whatever is in the accumulator, as an ASCII character. #FFED performs a carriage return and linefeed, but the real work is done by #C8E3 and #C589. The first looks up the name and value of the variable, as indicated by the name value in the Y register. This value is ASCII64, thus A=1, B=2, etc. Having found the value stored in the variable, it stores it on the 'workspace stack', at #15+X (LSB), #24+X, #33+X, #42+X (MSB). In our case X=1, so it's stored at the base of the stack, which is handy because the next call, to #C589, takes the value of the bottom of the stack and prints it as a decimal number. To make the printout appear in hex format, alter JSR #C589 (line 350) to JSR #C349.

The ability to shift blocks of user memory around is provided by listing 5 It takes defined chunks and moves them up or down – with a few error checks thrown in.

Listing 6. alters the LODVEC at #214, #215 to point to a new routine which gives a visible indication that a program is loading. It does this simply by storing the incoming byte in the top right of the screen, which now flashes as loading proceeds. It's short and simple, yet very useful. Once run, the routine will stay in memory until break is pressed (or the machine switched off). The same applies to the next routine.

In June's Beeb Forum, a routine was given which, when LIST is called, splits statements in multi-statement lines and prints them on separate lines. This is such a good idea that I've written an Atom equivalent.

The new list is activated by: L=-1; LIST (CR). Setting L to 0 (or any positive number) restores normal listing. This is done by lines 720 and 725, with a jump to line 760 the result if L is positive. Otherwise, the character in the accumulator is checked to see if it's a semi-colon, in which case a carriage-return/linefeed is output, followed by four spaces (lines 730–750), before normal printing resumes at line 760. Line 770 points the WRCHVEC to the new routine.

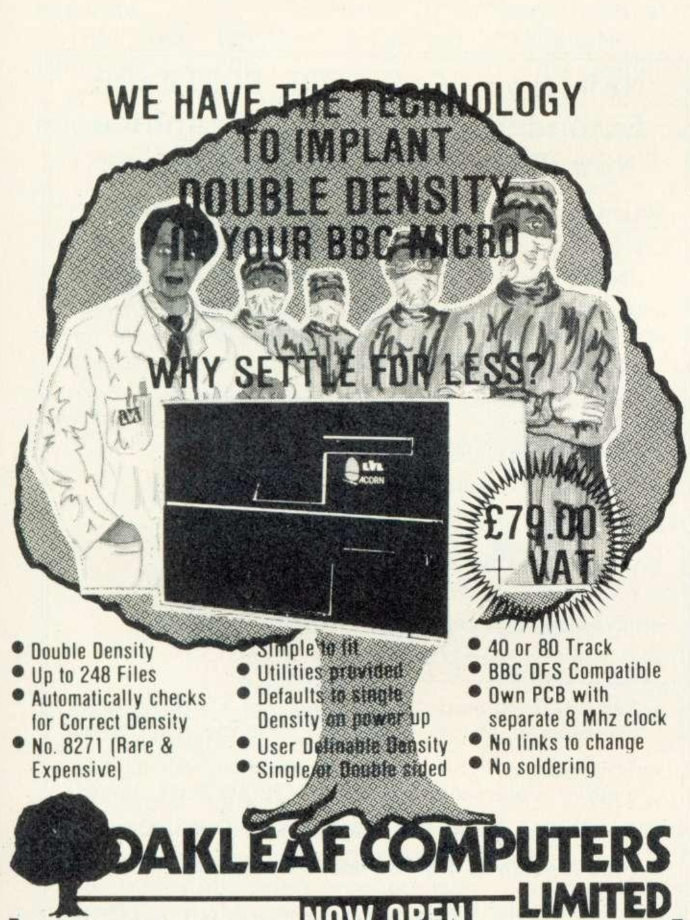
Listing 7 is the only routine that must be typed in every program you are debugging. Whenever an error is encountered, it prints out the offending line in full, along with the usual error message.

The Atom manual (page 137) provides a routine to alter the normal error handler. This program is a variation and the manual explains how it works. The reason why we need to write the error routine from scratch, rather than patch into the one already at #C9E7, is that the ROM version exits to direct mode – just what we don't want! Once debugged, these lines may be removed from your program. The end of line 9050 is *not* a mistake and all spaces are significant!

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REAL-TIME REFERENCE ROUTINES by Peter Hawkins

THIS program simulates the TIME variable on the BBC micro to provide a real time reference for other programs.

Listing 8 is a revised version of a very neat routine by Peter Hawkins which is entirely relocatable. To set timer to value T, type !#AC=T. It would be easy to modify this routine to give a real-time clock. To display elapsed time on screen, as part of a program, line 300 provides an example.

The program requires an Atom with RAM at #2800 and the VIA (6522). The IRQ link (LK2) must also be fitted. Timer 1 in the VIA is set to produce continuous interrupts at 10ms intervals (ie, 100 times per second). Each interrupt causes the contents of zero-page locations #AC to #AF to be incremented. Thus the command P.!#AC gives the time since the routine was called in 100ths of seconds and P.(!#AC)/100 gives the time in seconds.

The Time function is started using LINK #2800.

A description of the program follows. First, the set-up routine:

- lines 10–30 set up code location and dimension labels.
- 40–50 set IRQ vector to point to new routine.
- 60–70 zero 'time' variable.
- 80–110 set up timer 1 and enable timer 1 interrupt; start timer 1 and return.

Now for the interrupt handler:

- lines 120–150 turn off IRQ from timer 1; increment 'time' variable, allowing for any carry between bytes.
- 160 restores accumulator and returns from interrupt.

The program is 64 bytes long and the accumulator is the only register used.

Interrupts can of course be stopped by pressing break but a less drastic method is ?#B80E=127.

The interrupts, when enabled, do slow down the Atom but the only effect is to slightly lower the pitch of the bell character ($7 or CTRL–G). Unlike most interrupt programs, no screen noise is produced.

```
10 REM Atom time
20 DIM LL1
30 F.N=0 TO 1: P=#2880; I
40 LDA@(LL0&#FF); STA #204
50 LDA@(LL0&#FF00/256); STA #205
60 LDA@0; STA #AC; STA #AD
70 STA #AE; STA #AF
80 LDA@#40; STA #B80B
90 LDA@#10; STA #B806
100 LDA@#27; STA #B807; STA #B805
110 LDA@#C0; STA #B80E; RTS
120 :LL0 LDA #B804
130 INC #AC; BNE P+12
140 INC #AD; BNE P+8
150 INC #AE; BNE P+4; INC #AF
160 PLA; RTI; )
170 N.; E.
299 REM: Demo
300 !#AC=0; ?#E1=0; LI.#2880;
    DOP.$30; P.!#AC/100; U.O
```

Listing 8.

M/C TESTING by Stephen Foale

£10

WHEN developing machine code routines, it soon becomes tedious to have to keep typing something like LINK #2842 over and over again to test routines. The command line interpreter vectors, #206, #207, usually hold the addresses to point to a routine which executes the operating system commands, those which begin with a '*' (eg, *SAVE, *CAT, *NOMON).

The routine pointed to by the vectors is called whenever the Basic interpreter encounters a '*' Therefore, if these vectors are redirected to point to the address of your machine code routine, you will be able to call the routine by just typing '*'. For the example given above, to set the vectors to #2842, you would use the line:

?#206=#42;?#207=#28

Normal operation can be resumed by pressing break or restoring the old values by typing:

?#206=#EF;?#207=#F8.

★This is fine, but don't forget that all other *COS routines will be disabled, until you press break. If you want a function key operation which recognises all existing operators, you need to intercept the RDCHVEC at #20A,20B. The following simple program jumps to your own routine if you press CTRL–A, otherwise it behaves as normal.

In this, the jump is performed on line 25 to a routine which sounds the bell. Unless your own routine exits to direct mode, it should end with JMP(#20A). Other control codes (unused ones) may be used by altering the CMP on line 20. A is 1, B is 2, etc. There is, indeed, no reason why you should not lengthen the routine to allow multiple control-code functions.

```
5 REM: CTRL–A as function key
10 ?#20A=#1C; ?#20B=#2;
   REM: point to intercept routine
15 P=#21C; P.$21; [
20 JSR#FE94; CMP@1; BEQ P+3; RTS
25 JSR#FD1A / or your routine
30 JMP(#20A); ]; P.$6; E.
```

CHECKSUM ERROR CATCHER by R. Shelton

£5

WHEN loading from tape, it can be frustrating if a checksum error occurs but the prompt fails to reappear so the program can't be *FLOADed. This is because the Atom has failed to find a byte containing the value 13 followed by one containing 128 or more within 255 bytes of the error. This occurs on my Atom fitted with a Timedata board which when first powered up contains the values 0,255, 0,255, etc.

This can be avoided by entering in direct mode:

```
FOR X=#2900 TO #7FFC
    STEP 4; !X=#FF0DFF0D; N.
```

before loading a program. This takes a few seconds but ensures the prompt will reappear if a checksum error occurs.



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CORRECTING CASSETTE SPEEDS BY Alan Knowles

INCORRECT tape speeds can cause failures when trying to load programs from cassette, particularly at 1200 baud. However, some cassette recorders have a preset potentiometer to adjust the speed – the only problem then is to determine when it is correct. Program 1 means you can do just that. It was written for the Atom, but could be adapted for the BBC micro.

It takes the 2400Hz signal available at #B002 and compares it with that obtained from an accurate tape (again at #B002) when re-playing the high-tone leader. A suitable source for this would be a tape from a reputable software house, or a recording which has been checked.

The program counts 200 reversals of the 2400Hz signal and compares this with the number of reversals of the input signal. Any difference means the cassette recorder speed is incorrect. The percentage error is calculated by the Atom and displayed so the necessary adjustments may be made.

The listing can be considerably shortened by removing the REMs and using multi-statement lines.

Memory location #80 is used to store the value obtained from #B002 so changes can be detected using the EOR instruction on line 150. The AND instructions at lines 180 and 220 detect which signal has changed, so the appropriate counts are incremented (#81 and X respectively). Once X has been altered 200 times it will equal 0 as it was set to 56 at line 50. The program then leaves the machine code loop, the error is calculated (line 70) and displayed.

As well as being used to correct recorder speeds, the routine can match the speeds at which tapes have been recorded on badly-adjusted machines. These are difficult to use by any other method.

To record the high-tone signal, type SAVE "" as usual and set the recorder going with the record buttons down. Do not alter anything until a suitable length of signal has been recorded.

```
1   REM  ** TAPE SPEED TESTER **
2   REM
10   DIM PP(1)
20   P.$21;GOS.a;GOS.a;P.$6;@=0
30   LINK#FC4F;REM PRINT "PLAY TAPE"
40  bLINK#FB8A;REM WAIT 1/2 SEC.
50   ?#80=0;?#81=0;X=56;REM PRESET COUNTS
60   LINK PP0
70   P."TAPE IS "ABS((?#81)-200)/2,"% "
80   IF ?#81 > 200 P."FAST"';G.b
90   P."SLOW"';G.b
100   END
110 aDIM P-1
120 [
130 :PP0 LDA#B002
140   TAY
150   EOR#80 PREVIOUS STATE OF #B002
160   STY#80 SAVE NEW STATE
170   TAY
180   AND@#20 TAPE SIGNAL SAME?
190   BEQ PP1
200   INC#81 IF TAPE INPUT CHANGE
210 :PP1 TYA
220   AND@#10 OSC 2.4 KHZ CHANGE?
230   BEQ PP0
240   INX IF 2.4 KHZ TRANSITION
250   BNE PP0 UNTIL 200 TRANSITIONS
260   RTS
270 ]
280   RETURN
```

Program 1.

BBC BOARD MIS-MATCH WITH DISCS

ELIZABETH Parry of Newbury writes with some problems encountered since fitting the BBC Basic ;board to her Atom.

The first concerns her Microline 80 printer, which works fine in BBC mode, but overprints lines in Atom mode. This is because it is not performing an automatic linefeed after each carriage return. The solution is to type ?#FE=#FF, before printing in Atom mode. This over-rides the normal routine, which inhibits linefeed characters.

Elizabeth also reports being unable to retrieve programs from disc, without corruption. Both the Atom disc pack and the BBC card contain extra RAM, addressing from #2000 to #27FF, with the result that part of the data is stored in one set of RAM and part in another. The answer is to remove the relevant chips from inside the disc pack. You will need to examine the disc pack's circuit diagram to find out which these are (since there is 3k of RAM there) and to modify the BBC card for addressing at #3C00 (see *Acorn User*, March).

Whilst on this subject, note that, in BBC mode, the external bus (PL7/PL6) is disabled and memory boards using this (eg Timedata) do not operate normally. To correct this, bend outwards pin 11 of IC14, so it no longer makes contact with the socket, and connect it to pin 12 of IC12. Operation of the extra memory will now be transparent in either mode.

Finally, Acornsoft will provide a circuit diagram of the BBC board, on request (please enclose a sae).

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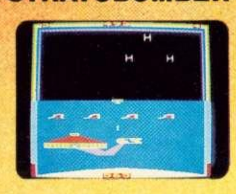
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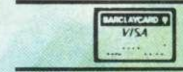
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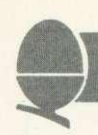


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WITH a maximum board capacity of 12k RAM, it's not surprising Atom owners seek more extensive memory expansion. A number of RAM boards can satisfy this need, each with its own design philosophy and distinctive features. Two products are considered here: a 17k RAM board from Control Universal (the Atomplus), and a 16/32k expansion card from Timedata.

First, the interconnection details. Control Universal's board comes fitted with a standard 32-way indirect connector. The recommended method of interfacing is to solder a 32-way strip of PCB pins to the internal bus connector holes on the Atom's circuit board (marked PL7). A 64-way ribbon interface cable then connects the pins to the Atomplus. (Neither the PCB pins nor the cable are supplied.) The card itself is bolted to the base of the Atom case.

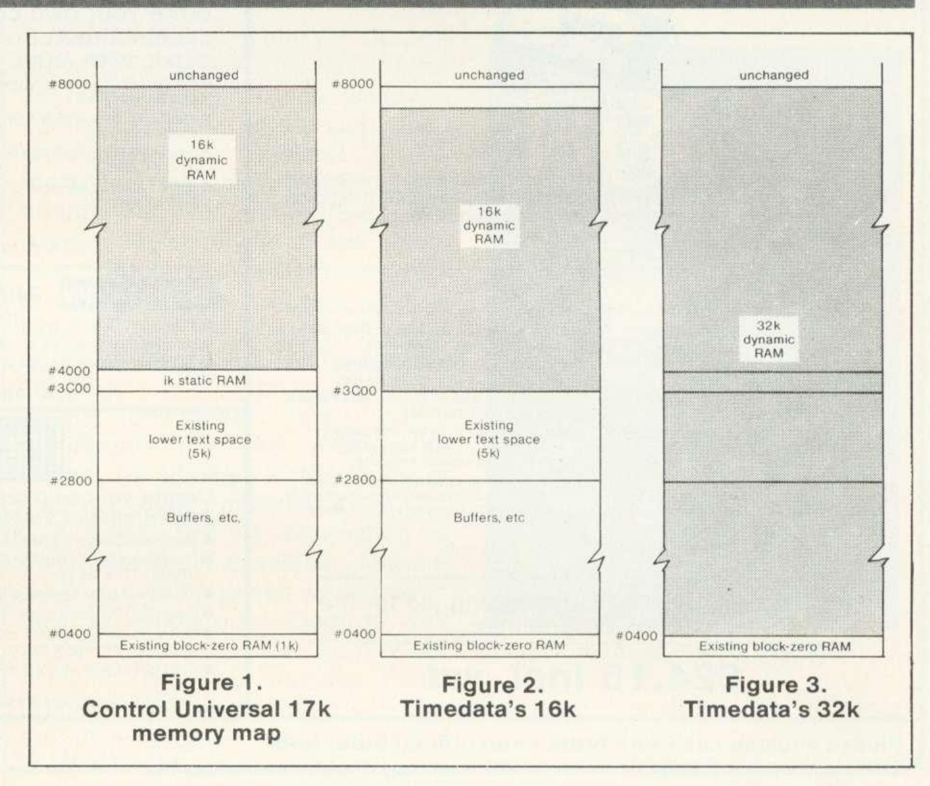


Figure 1. Control Universal 17k memory map

Figure 2. Timedata's 16k

Figure 3. Timedata's 32k

Timedata's board also requires PCB pins to be soldered, and these are provided. The pins then plug into a matching socket mounted directly on the underside of the card. This brings the board up flush with the main PCB. The RAM board also has a piece of stiff card fixed to its underside, to minimise any risk of short-circuits. Timedata maintain that the Atom's external bus buffer chips need not be fitted, thereby saving additional expense.

The 17k RAM on the Atomplus consists of 16k of dynamic RAM occupying addresses #4000 to #7FFF, plus an extra 1k of static RAM to fill the 'gap' in the Atom's memory map, at #3C00 to #3FFF. When combined with existing memory, the Atom now has 29k of RAM (including screen memory), arranged as in figure 1. To look at it another way, this gives the user an uninterrupted 22k of lower text space from #2800 to #7FFF.

Although we still have a 'gap' in the memory map, at #0400 to #27FF, one can perhaps understand Control Universal's decision to provide just 17k of expansion. The aforementioned area of memory can be difficult, or impossible to use for certain applications. Two such examples spring to mind. First, using Acornsoft's Wordpack, there is no way to store text below the buffer's default starting address of #2800, so memory below this would be wasted. Second, although a 31k Atom Basic program is feasible, it would not be possible for it to use floating-point arithmetic, as the page from #2800 to #28FF is reserved for FP variables. As soon as a FP operation was executed, part of the Basic program would be overwritten! In any event, by using the default text space from #2900, there is no need to reset the text space pointer (after break, etc).

Timedata's expansion board is supplied fitted with either 16k or 32k of RAM, and both single-rail (5V) or multi-rail versions are available. The latter are cheaper, but require an extra DC converter module if you don't happen to have a suitable power supply. For the purposes of this review, I used a 16k single-rail version.

A versatile feature of Timedata's card is that the RAM can be addressed on *any* 1k boundary within the lower 32k of memory. This is particularly valuable to those using the BBC Basic board and/or Atom disc drive, so the extra RAM provided by these devices is not wasted. Resolving memory conflicts in such cases can require some head-scratching. Fortunately, Timedata provide a three-page document on using their expansion boards with disc and/or BBC Basic.

Normally, however, links on the 16k RAM board will be configured to reside from #3C00 to #7BFF, as shown in figure 2. This closely matches the Control Universal configuration, giving a lower text space of 21k, just 1k shorter.

Use of the 32k RAM produces the memory map in figure 3. An added bonus is that 6k of Atom static RAM is now no longer required.

Clearly, there are no particularly special techniques to be learned to use the expansion boards. The extra RAM, once tested, can be used like any other memory space. Remember, however, that no commercial software has been written to exploit such expansions and users should be prepared to develop programs to make full use of the extra memory. Nonetheless, the benefits offered by the extra RAM might not all be immediately obvious. The ability to write longer Basic programs is undoubtedly attractive, but the advantages don't stop there. Using Wordpack, I could prepare and edit large documents as one file, rather than

Prices (exclusive of VAT) are as follows:

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32k RAM (multi-rail)	£64.35
32k RAM (5V)	£81.74

having to save and load several smaller ones via tape. (Yes, this review was written on an Atom, fitted with Wordpack and a memory card.) For the first time, I could enjoy full resolution grahics whilst using Forth (not really possible on the 12k Atom), yet still have lots of free dictionary space. Atomcalc users can now tackle larger and more ambitious spreadsheets – indeed, one packaged spreadsheet system is little more than an Atom with Atomcalc and RAM expansion.

The only problem I encountered using the boards was the lack of space in the Atom casing. The boards *can* fit inside, at a squeeze, but it's all too easy to make the main board flex under pressure. Incidentally, BBC board users will have no choice but to house either RAM card externally.

Which board is best for you? For a limited budget, the cheapest solution would be to purchase a bare PCB from either company, though this is not a step for the faint-hearted. If you want maximum memory irrespective of cost, the Timedata 32k RAM card is the obvious choice. On the other hand, if you're sure 22k is all you need, Control Universal's 17k expansion (plus the lower text space memory) would suit your requirements. However, due to a recent price rise, the latter actually costs more than the 32k version of Timedata's board. Without a revision in pricing strategy, it's difficult to see how it could win votes from the opposition. Lastly, if you're not sure exactly how much RAM you need, Timedata's offering does have the advantage of expandability. The 16k version can be upgraded simply and cheaply by plugging in eight extra memory chips.

Vincent Fojut

SUPPORT FOR DISC USERS

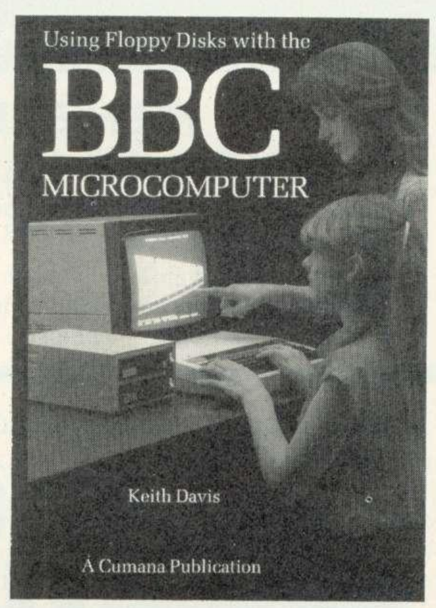
CUMANA has published a support disc (£3.45) and manual (£9.95) for its range of drives – a welcome addition for those who bought early undocumented systems. The manual is very easy reading, and though not as detailed as the Acorn version, covers all the points which would cause first-time users problems. The book is well laid out, with plenty of diagrams and photographs. Obviously the emphasis is on Cumana products, and I found comments like 'It is unfortunate that the above sum cannot be applied to the price of the drive' quite amusing.

A good deal of information is given about the problems encountered in making drives work, and in how to reconfigure them to suit one's own needs. The book even explains how to relocate Basic programs below &1900, PAGE for the DFS. (Actually, that particular routine might look a trifle familiar to *Acorn User* readers!)

The book is not complete in two particular areas, which are mainly the province of the more advanced user. The section on random access could be more detailed, relying as it does on PRINT# and INPUT#. In addition, the use of OPENUP/OPENIN for random access is not mentioned. Several colleagues assumed the section on OPENOUT was for printing to a file and, unfortunately, this is true. I say unfortunately because on OPENing-OUT a file for printing, the book says that file is checked for, then 'if it exists and is not locked it is used'. Yes it is, but by first *deleting* the file, and then opening it again *as an empty file*. This could cause some upset, and users are encouraged to read up on the past issues of *Acorn User* to examine ways round this.

The other major exemption from the book are the access calls to the filing system which are helpful for the advanced user. My general impression was however favourable. So many firms sell products without adequate documentation, that when one produces a generally helpful text like this, they are to be applauded.

The other part of the package is a formatting disc, which must be



Cumana manual is easy reading

the most amusing utility to date. Typing *FORM40 or *FORM80 causes the formatter to load and set up a screen in mode 1. A yellow wedge shape showing the number of tracks on the disc appears followed by the message: 'On which drive do you wish to format?' The answers 0, 1, 2 or 3 are acceptable.

Almost Beethoven

The program then checks for data or a preformatted disc and warns if one is found. The next step is to format the disc, and as each track is formatted, so its image on the screen turns green if OK, yellow if retried or red if the track won't format. Any red track means the disc needs committing to the rubbish heap. A completely green disc results in the first few bars of what almost sounds like Beethoven's Fifth, while a failed disc is indicated by a funeral march, plus the message: 'Fatal formatting error'.

Cumana is also preparing a verify program, though this wasn't in my package. One of the pleasant features of the product is that the firm permits copying of the formatter and its instructions except for financial gain. Contact Cumana at Unit 1, The Pines Trading Estate, Broad Street, Guildford, Surrey.

Joe Telford



BEEBUG FOR THE BBC MICRO

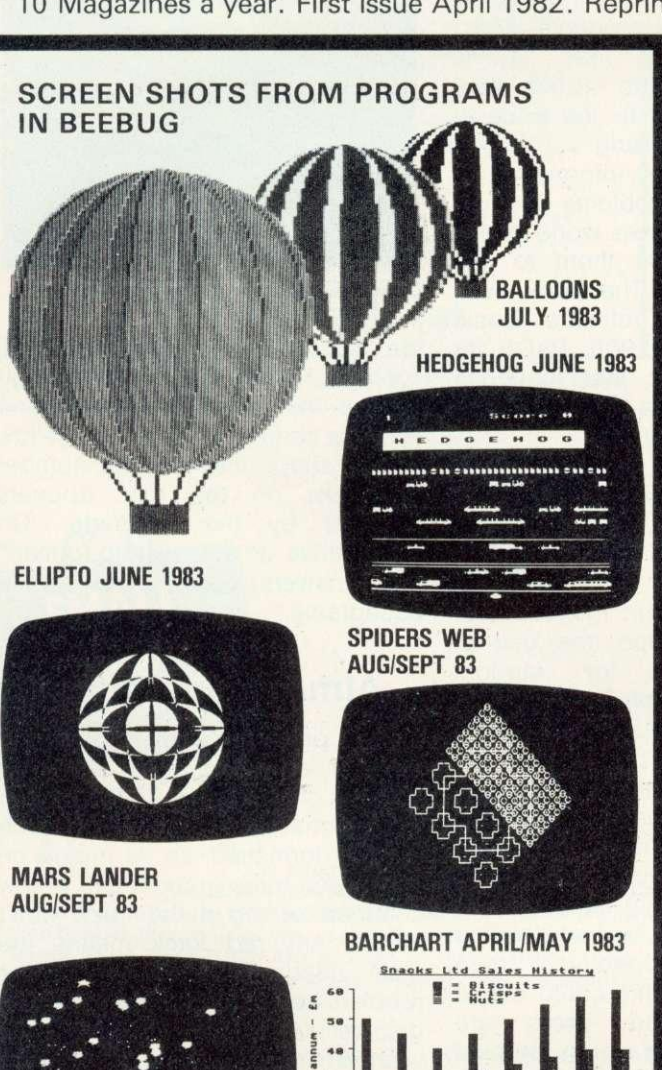
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George Hill gives his opinions on a Logo package for schools

FOLLOW THAT TURTLE

EDUCATIONAL software is of a very low standard generally, but Logo is one of the exceptions, and in my experience has met with universal enthusiasm from teachers.

Logo challenge is a version of the language specifically developed for use in schools. From the *Horizon* programme on TV, or from articles, you will have gathered Logo is a drawing program. It is based on the 'turtle graphics' principle, in which the pen behaves like a turtle (or a snail, as it leaves a trail!). The turtle can be directed around the screen by such commands as:

FORWARD n – where n is the distance.
LEFT m – where m is the angle.

The turtle's current position and direction is indicated on the screen by a small arrow at the pen-point. It can also be followed by the WHERE command, which gives at the top of the screen the X and Y coordinates, and the current direction as a bearing. The angle is between 0 and 360 degrees (figure 1) and figure 2 shows a typical screen.

In its full (mostly American) versions, Logo is much more than a simple graphics program. It is a full language in its own right, having features in common with Lisp (from which it stemmed) and Forth (where 'words' are also the basic unit of the language). It is fully structured (no GOTOs), and the idea is to define words which carry out procedures, and can then be used in the definition of other words. For example;

```
TO SQUARE
REPEAT 4
FORWARD 60
LEFT 90
AGAIN
END
```

would define a square in standard Logo terminology. Now,

```
TO PATTERN
REPEAT 36
SQUARE
LEFT 10
AGAIN
END
```

will draw the pattern of squares in figure 3 when the single word PATTERN is typed.

Notice the structures; REPEAT... AGAIN, (the equivalent of Basic's FOR ... NEXT loop) and TO ... END, (the approximate equivalent of DEFPROC...ENDPROC, or GOSUB... RETURN). In Logo Challenge, TO...END has been changed to DEFINE...END, and there are various other minor

90°
increasing angle
180°
0°
270°

Figure 1. Angular measurement

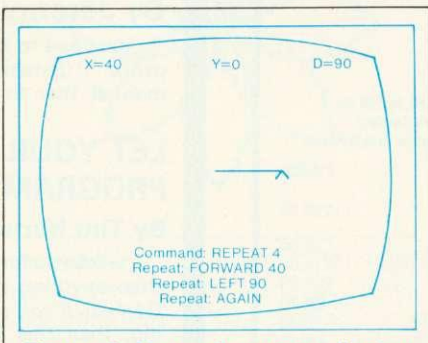


Figure 2. Example screen display

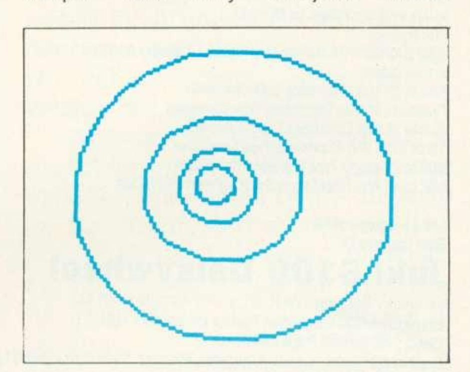
differences from standard terminology. Three variables SIZE, ANGLE and NUMBER are available to allow flexibility within the REPEAT...AGAIN and DEFINE ... END structures. These variables can be set, eg by SIZE=70 (or SIZE 70). Simple arithmetic can be done on these variables, such as SIZE=SIZE+10.

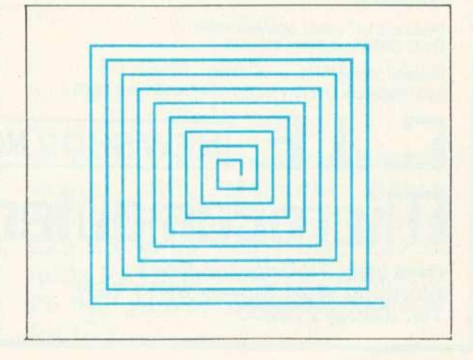
Full implementations of Logo include many more advanced features, making it an almost infinitely extensible and flexible tool, in which complete 'micro-worlds' can be defined for the child to explore. These features include string handling, definitions of 'sprites', (graphics shapes) and the use of defining words which include a variable entered as a part of the word. For example,

```
TO SQUARE :SIZE
REPEAT 4
FORWARD :SIZE
LEFT 90
AGAIN
END
```

will allow you to type SQUARE 80, and the computer will draw a square of side 80 units from the current pen position. These features are *not* available in Logo Challenge. For a description of the language in its full American versions, see the August 1982 issue of *Byte*, or *Classroom Computer News*, April 1983.

Logo Challenge is a very limited sub-set of the full language, being entirely restricted to drawing lines in one colour. It supports only the minimum of structures and variables. (DEFINE ... END REPEAT ... AGAIN, NUMBER, SIZE, ANGLE). However, this is perfectly adequate for introducing young children to turtle graphics and gives an excellent grounding in structured programming. It also helps with any subject which





BBC SPECIALISTS

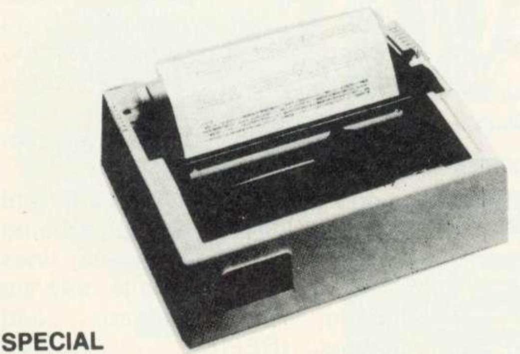
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requires logical thought, most obviously assisting in geometry (and maths generally).

The LIST, DESCRIBE, HELP and EDIT functions are neatly and efficiently realised, though I did not find the error messages particularly helpful. A full list of the available commands (which are pretty self-explanatory) is given in table 1. (In the list is the mysterious variable VALUE – never mentioned in the text!)

FORWARD (FD)
BACKWARD (BD)
CLEAR (CL)
HOME
UNDO
LEFT (LT)
RIGHT (RT)
REPEAT (RP) AGAIN (AG)
DEFINE
DEFINE (DF) END (EN)
PENUP (PU)
PENDOWN (PD)
DESCRIBE (DS)
LIST (LS)
DELETE (DL)
EDIT (ED) R (Replace) D (Delete) I (Insert)
NUMBER, SIZE, ANGLE, VALUE (variables)
FINISH
SETX (SX), SETY (SY)
SCALE (SC)
HELP (HP)
HIDE (HD), SHOW (SH)
WHERE (WH)

Table 1. Commands available

Each pupil or group is encouraged to keep a data file of commands. This can be saved at the end of a session, and re-loaded later. If the file is up-dated during the session, a new version can be saved to replace the old one after finishing.

The cassette version was 'bug-free', although there were some oddities in the disc copy. These concerned the lack of error messages when attempting unsuccessfully to save data files, and the fact that the original file is lost if updating occurs (no backup file is created).

No provision is made for using a printer. Hence it is not possible to list the available commands on the printer, which would ease error correction, particularly when defining more complex words. It is also not possible to reproduce the graphics screen on a dot-matrix printer. This is a pity as a hard copy capability would make the package even more attractive. A child would be much encouraged by having a permanent record of the results of his or her success, and Logo produces attractive pictures for classroom displays.

The main criticism of the original 380Z version of this program (Croydon Logo) was its slowness, and in the BBC micro version there is little difference. The HIDE command allows drawing to take place at an accelerated rate, by hiding the turtle arrow, but considering the speed of BBC graphics this remains a pretty pedestrian effort. The program is in Basic and so could never be super-fast, but the slowness is compounded by the programming because it has been translated from another version of Basic, probably the 380Z version. It is highly inefficient, using no procedures, no integer variables and no byte indirection, and is quite impenetrably illegible. The program and its attendant variables take up a huge chunk of memory, and so it only runs in mode 4 (hence no colours). The reason for my criticism of the programming is that there are circumstances where the teacher may wish to make alterations. For example, the program uses VDU 19 to re-define the foreground and background colours to green and blue (not a happy choice in my view!). Those with monochrome TVs will find the constrast insufficient, and will wish to change the colours back to white on black. Second, changes to allow the use of the printer are difficult, and would be beyond most teachers.

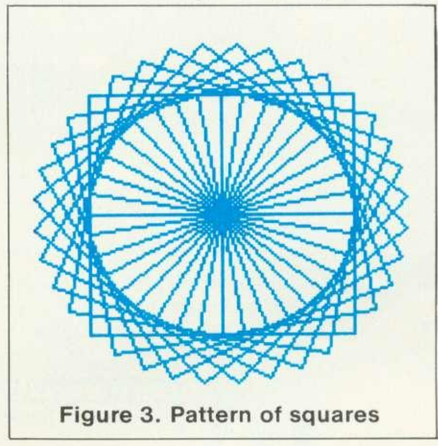
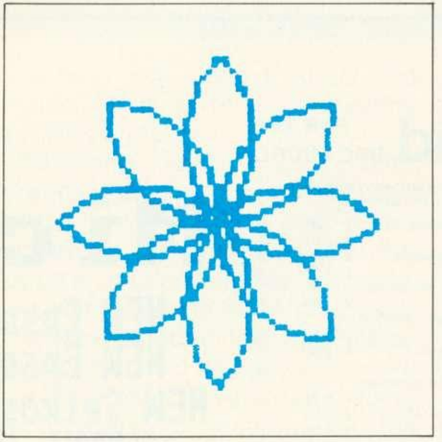


Figure 3. Pattern of squares



The program is 'error-trapped', principally I think to stop the escape key from having its normal function. I find this extremely annoying, and the resulting error messages, eg 'Error number 11 at line 490' are enough to strike terror into the heart of any teacher, let alone pupil.

Logo Challange's major plus is its documentation, particularly the pupil booklet. This is a model of clarity, and leads the pupil through the learning stages gently and efficiently. My children were able to follow the booklet, and progress rapidly with the minimum of assistance (or interference) from me – an enormous advantage for a busy teacher. The teacher booklet is similar, but more explicit. It lacks a listing of all the words in the TEACH file, but does contain sample solutions to all the challenges (the teacher can keep ahead – for a while anyway). It also contains the only full explanation of the EDIT function, which I found pupils needed rapidly.

Overall, this package could be extremely valuable in primary schools, and possibly at the lower levels in secondary schools. It is well thought out, well documented and it works. It forms an excellent introduction to the use of computers generally, and is ideally suited for a child's (or adult's) first hands-on experience of computing. No school should be without a version of Logo.

This version, though limited, is excellent value. The package includes two copies of the cassette (or two discs), and a copy each of the pupil and teacher booklets. Further copies of the booklets can be purchased. It is available in versions for the RML 380Z and 480Z, the BBC micro (model B) and the Sinclair Spectrum.

P.S. The Logo face in this and the last issue is by Miranda Hill, after an hour with the package.

■ **Logo Challenge by Heather Govier and Malcolm Neave, Addison Wesley. Cassette version £29.95 (plus VAT), disc £37.95 (plus VAT), Teacher's guide only, £5.95, pupils booklets, £14.95 for five.**

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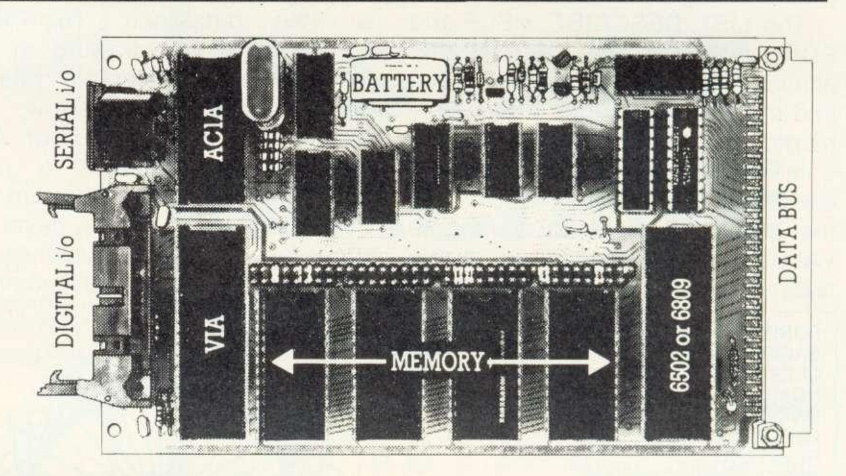
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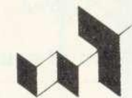
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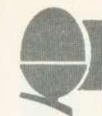
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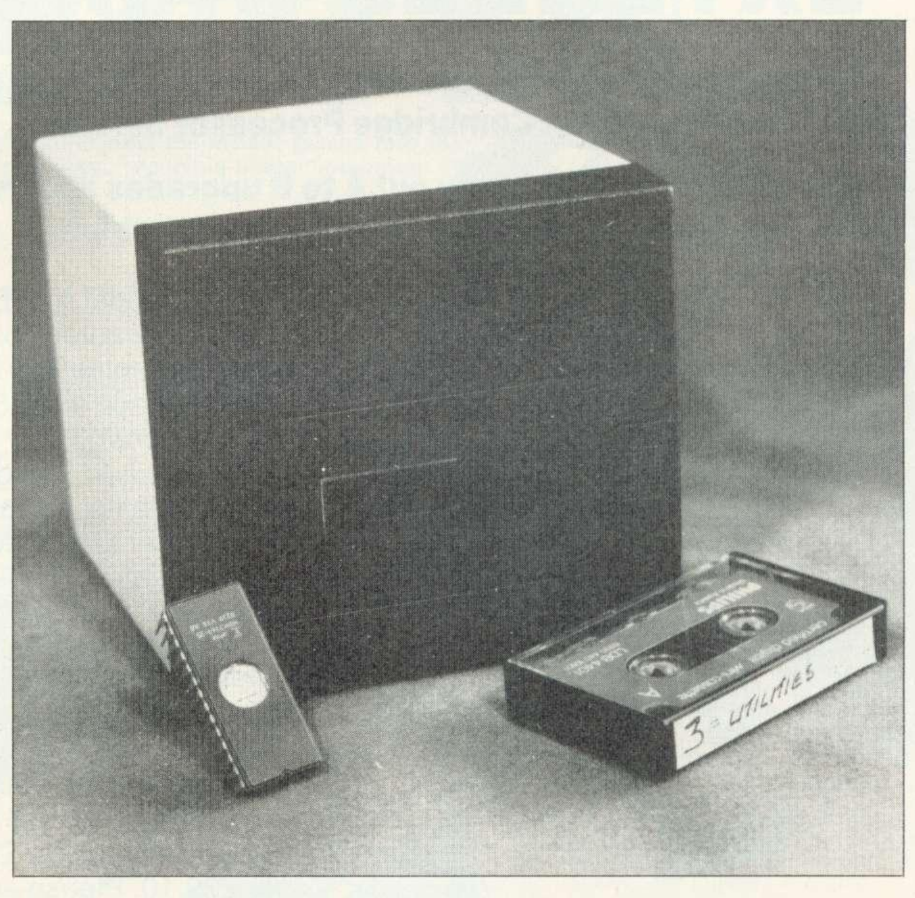
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MAKING A HABIT OF THE HOBBIT

Simon Dally has been using this fast floppy tape system



■ **Hobbit Floppy Tape System, Ikon Computer Products. £135 + VAT (no disc interface required).**

THE Hobbit is a chunky-looking black and white metal box, not much larger than a box of sugar lumps. It comes with a ribbon cable which plugs into the user port of the Beeb, a cable which goes into the power-our socket beneath the micro, an operating system chip and a professional-looking manual. Up to two Hobbits can be used at any time.

The fitting instructions are quite clear. The only worry for the nervous is in fitting the chip – being ham-fisted I broke a pin on mine and had to ask for another. Also, opening up your computer can void the guarantee so if you have any doubts get your dealer to do it. My ROM didn't work at first but a quick phone call to Ikon established that I had an early machine and needed to cut a couple of small links on the PCB.

The panic over, I switched on and everything worked a treat.

The Hobbit stores and retrieves programs and data from micro-cassettes (the type used frequently in dictaphone machines). As with discs, before you can store anything you have to format the cassette – this takes it about five minutes. Then you're ready to plonk your files on to it.

Switching back and forth between the tape system and the Hobbit is child's play and transferring software on to the Hobbit's microcassettes is easy, even with machine code programs. Once you've done this the Hobbit really comes into its own.

Having been driven frequently to the borders of insanity by the cassette loading system on my Beeb I cannot begin to describe the liberation one feels at typing *CAT and seeing a well-designed index to the tape appearing on the screen. Programs which hitherto took three minutes to load even without those tiresome 'Rewind tape' messages now come up in 30 seconds, though this can vary depending on whereabouts on the cassette the Hobbit has stored it.

I cannot begin to describe the liberation

But the important thing is that you dispense with tape counters or unplugging the earphone socket to hear where the program begins: the Hobbit keeps track of the position of all files on the tape. To the cassette user it is the equivalent of the owner of a hand-cranked car suddenly acquiring a model with a self starting motor.

Various types of files can be created (including random access files) and there are commands enabling you to append, write only, read only, delete. There are also some built-in checks which ask you to confirm your instructions if you're about to wipe something out: in fact the only way you can accidentally erase data is by switching the Hobbit on or off with a cassette in it.

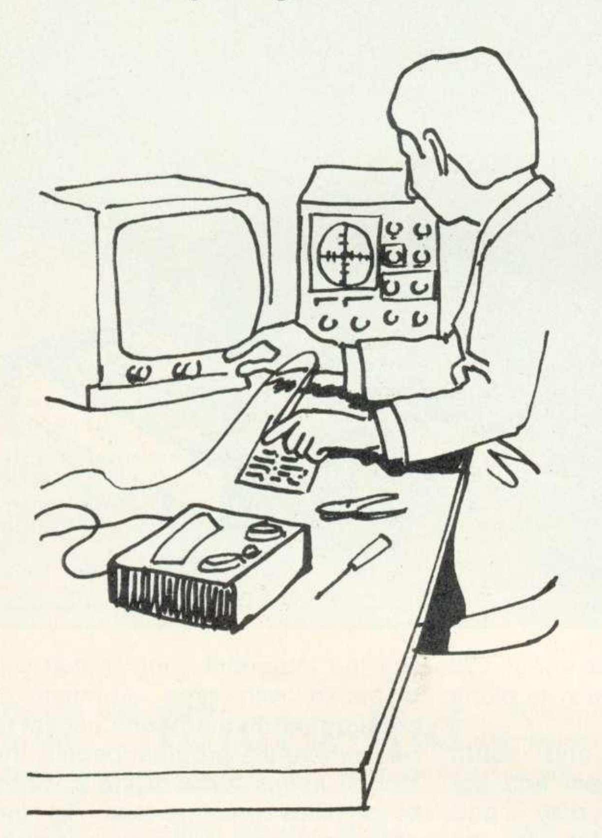
If you use a home computer for serious purposes and cannot tolerate any storage erros whatsoever, you shouldn't rely on any kind of tape-based system. But for those who find ordinary cassettes frustratingly slow and who cannot afford the cost of a disc interface and drive(s) the Hobbit is an impressive and reliable compromise.

Simon Dally

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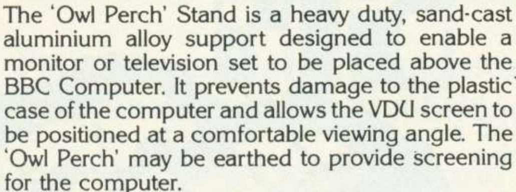
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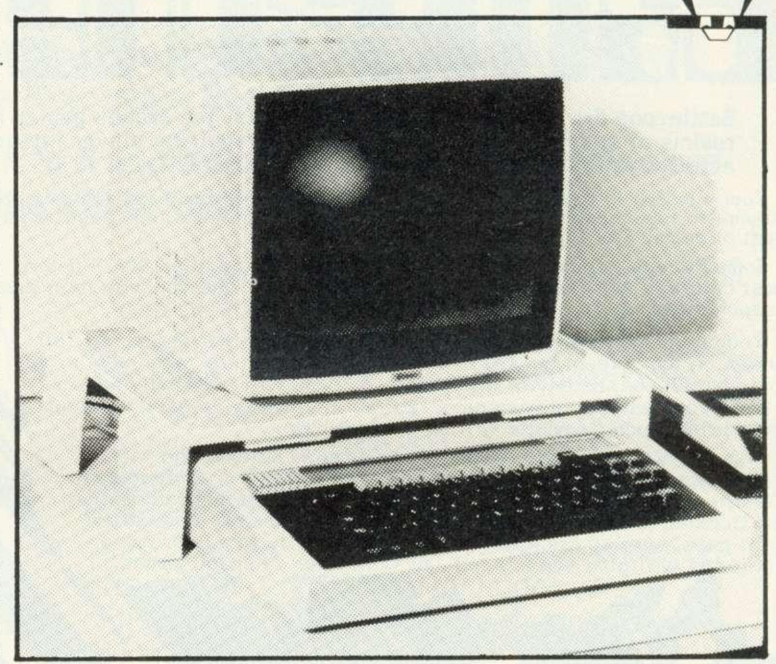
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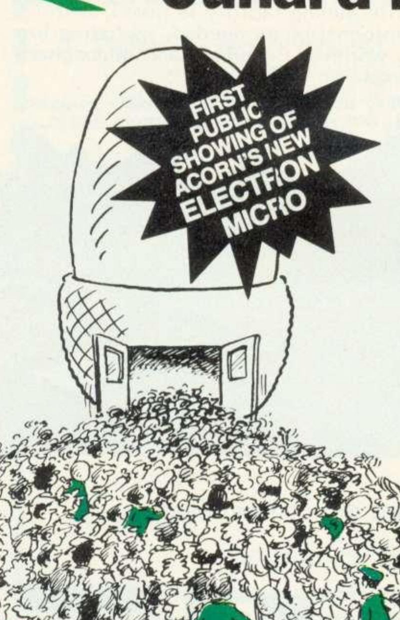
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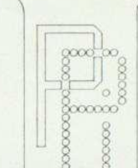
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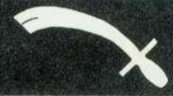
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FUN IN THE JUNGLE

■ The BBC micro book: Basic sound and graphics, by Jim McGregor and Alan Watt, Addison-Wesley, 156pp, £7.95

BEFORE I opened this book, the cover made me feel it was going to be exciting. It portrays a dramatically coloured jungle, with the Beeb zooming in like a flying saucer. The back cover states that the first part of the book teaches Basic in clear and simple terms and that the second part comprehensively covers graphics, animation and sound. This is exactly what the book does.

The book has a preface, an introduction, 11 chapters, 10 appendices and an index. The introduction gives a glimpse of what the Beeb can do. Then come the fist seven chapters which certainly do help the reader to get to know Basic.

Chapter 8 is on Teletext, mode 7. It explains how to produce colour and graphics in this mode, and provides example programs. (It does, however, make the mistake of saying Teletext offers 80x75 block graphics. Since a two-block character space must be occupied by a code to switch on block graphics, Teletext offers a maximum of 78x75 blocks.) The book recommends mode 7 for listing and editing programs generally – a good idea.

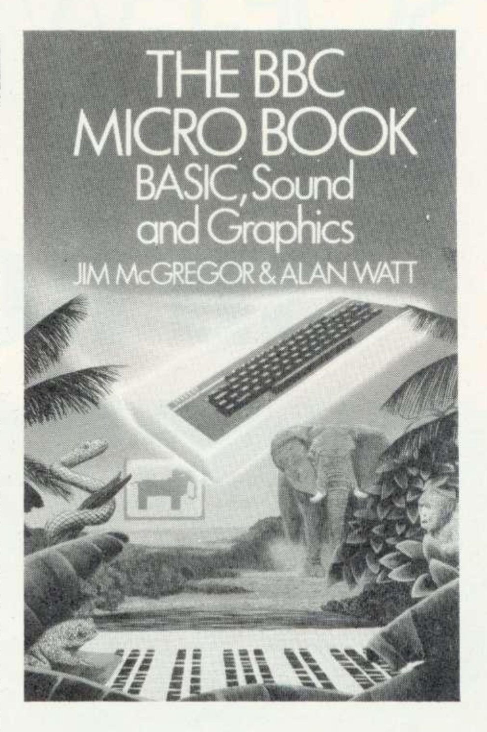
The last three chapters explain in detail how to produce your own graphics and sound. Chapter nine delves fairly deeply into graphics, showing how to take advantage of the Beeb's special features. Programs are provided which achieve interesting displays and anyone interested in Beeb graphics should benefit.

I was particularly interested in the claim: 'before too long, you'll be writing and listening to music.' Now I'm not particularly musical. I don't understand music and realised I was not making anywhere near full use of the Beeb's sound facilities. But this book really did help, and conveyed a feeling of confidence in the subject. The 40 pages devoted to sound made me feel that the authors really did understand music and how to use it on the Beeb. After reading it, I actually managed to get a tune out of my Beeb! I also enjoyed trying to imitate musical instruments. For me, this was no small achievement.

The title of the last chapter is animation, but it also includes various other programming aspects, such as programmable characters and composite figures. It starts by discussing the principles of animation and then illustrates them through a program which bounces a ball around the screen. The chapter goes on to the idea of animation by redefining colours – well worth describing because of the smoothness of the resulting movement.

The 10 appendices cover 50 or so pages. The first is concerned with editing programs. Appendix 2 deals with files: it describes saving and loading a program, how to create and read from files, and how to merge two programs. In my opinion, this was well done – much better than in the *User Guide.* Appendix 3 is on operator precedence in arithmetic expressions, while appendix 4 summarises mode and colour facilities. Appendix 5 explains bits, bytes and hex. Appendix 6 is on formatting for printing. Appendix 7 is concerned with character codes, special VDU codes, and Teletext control codes. Appendix 8 covers program efficiency, and demonstrates quite dramatically how a different algorithm can radically change the execution time of a program. Appendix 9 gives a list and brief description of all the BBC Basic keywords. Finally, the operating system commands used earlier in the book are explained, and these are, in my experience, the most useful.

The book concludes with a six-page index – and I know I am not alone in regarding a good index as essential for any book to be used as a reference. Nevertheless, I am surprised at



the number of computing books that don't bother to include one.

Now for some general comments. I liked the logical sequencing of the book and the way it is divided into sections, each covering two to three pages and typically containing an explanation of a topic, examples and exercises. I would imagine, though, that readers would prefer solutions to these exercises. The book is easy to read, with Basic, graphics and sound described clearly and simply. Text and examples back each other up so any points which may be difficult to follow in one, are invariably clarified by the other. Good use is made of diagrams, often showing the output from a program as a screen display.

Apart from the necessary description and examples of the GOTO statement, the book makes extensive use of both REPEAT . . . UNTIL loops and procedures. It therefore manages to eliminate GOTO statements completely, so demonstrating and encouraging structured programming. I was sorry that this important aspect of good programming practice was not stressed. It would have been nice to see the authors make this point.

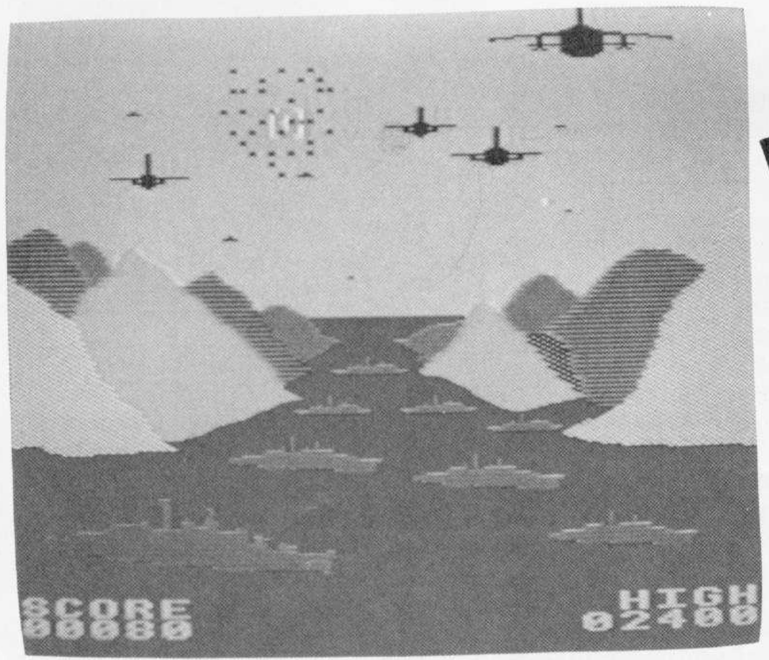
Overall, I liked this book very much.

Andrew Cryer

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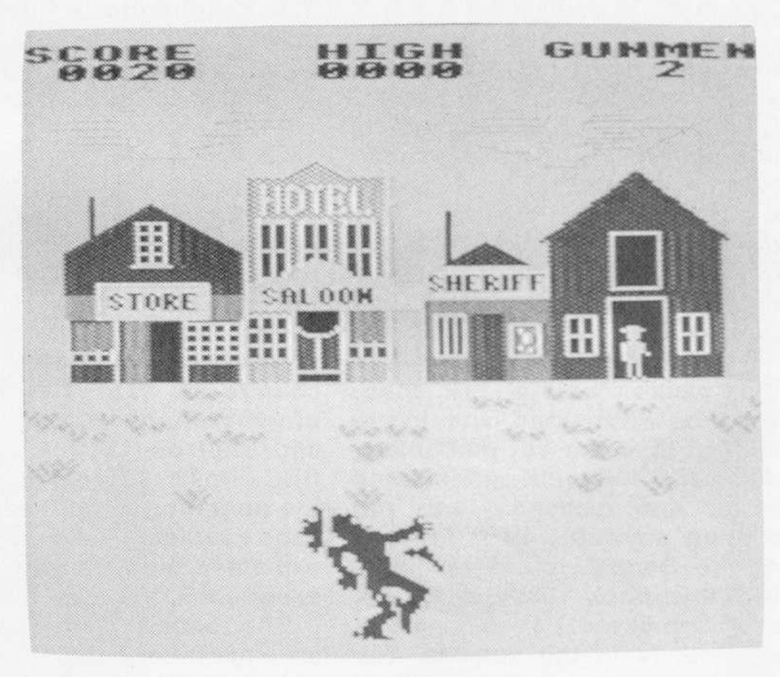
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SOFTWARE INVASION, 50 Elborough Street, Southfields, London SW18 5DN.



□ BBC users in **Luton** should write to Roy Baxter at 69 Cromwell Rd, Luton LU3 1DP, who wants to form a club in the area.

BOYS IN BRUSSELS

□ The BBC micro is a hit in **Belgium** and the country already has a user group: Acorn Computers Users Club, BP 325, 1000 Brussels 1. The Club issues a monthly newsletter and has bi-monthly meetings in Brussels and several provincial cities. Jean-Louis Meerts at Rue de la Sympathie, 24, B-1070 Brussels, can supply you with a free copy.

□ R. Houghton is starting a club for BBC owners in the **Wellingborough** area of Northamptonshire. His address is 49 Addington Road, Irthlingborough. Tel: Wellingborough 650883 (evenings).

□ **Cardiff BBC Computer Club** (CBCC) holds meetings on alternate Wednesday evenings at Cardiff University College. Information from Geoff Barker, Chairman CBCC, 2 Whitcliffe Drive, Penarth, South Glamorgan (0222 701023).

□ANYONE living in **King's Lynn** and the surrounding area can now join a BBC User Group. Contact Mike Floyd on King's Lynn 61144 ext 323.

CLUB CONTACTS

● Rupert Steele
Amateur Computer Club
St John's College
Oxford OX1 3JP

● **Beebug**
374 Wandsworth Road
London SW8 4TE

● J. Smith, Secretary
Brighton, Hove & District Computer Club
30 Leicester Villas
Hove
E. Sussex BN3 5SQ

●Dr Leo McLaughlin
North London BBC Micro Users Group
Dept. of Chemistry
Westfield College
University of London
Kidderpore Avenue
London NW3 7ST
Tel: 01-435 0109

● **West Midlands Computer Group**
12 Apsley Road
Oldbury
West Midlands B68 0QZ

● Mr J. Price
Bedford House
27-28 ST George's Road
Brighton
Sussex

● Mr P. Beverley
Norwich Area Acorn User Group
Room 12a, Norwich City College
Ipswich Road
Norwich NR2 2LJ

● Keith Mitchell
Edinburgh ZX Computer Club
19 Meadowplace Road
Edinburgh
Tel: 031-334 8483

● Steve White
Atom/BBC User Group
c/o Superior Systems Ltd
178 West Street
Sheffield
Tel: (0742) 755005

● Robin Bradbeer
Association of London Computer Clubs
Polytechnic of North London
Holloway
London N7 8DB

● Nik Kelly
Liverpool BBC & Atom Group
56 Queens Drive
Liverpool L4 6SH
Tel: 051-525 2934

● Andy Purkiss
Namebug
6 Palm Close,
Witham, Essex.
Tel: 0376 515609

● I. Beng
BBC Micro Club
PO Box 1297
Santa Cruz de Tenerife
Tenerife

● Lindsay Thachuk
Beebnet
PO Box 262
Kingswood
South Australia 5062

● Richard Sterry
BBC Micro User Group
1 Wavell Garth
Sandal Wakefield
West Yorkshire WF2 6JP
Tel: Wakefield 255515

● Colin Price
Keighley Computer Club
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Hainsworth Wood
Keighley
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Tel: Keighley 603133

● Jennifer Woeller
Sutton Library Computer Club
Sutton Central Library
St Nicholas Way
Sutton
Surrey
Tel: 01-661 5031

● Mr C. Rutter
Medway Atom Users Club
St John Fisher School
Ordnance Street
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Kent

● Mr J. Ashurst
Acorn Computer Users Group
Abraham Moss Centre
Crescent Road
Manchester 8

● Mr D.L. Evans
23 Hitchin Road
Henlow Camp
Bedfordshire

● N.P. (Bazyle) Butcher
Harrow Computer Group
16 St Peter's Close
Bushey Heath
Watford WD2 3LG

● R. Welch
Harpenden Microcomputer Group
7 Tylers
Harpenden
Herts AL5 5RT

● Mr P. Frost
Atom Users Group
18 Frankwell Drive
Potters Green
Coventry CV2 2FB

● Oivind Grenness
BBC Norway
O-Inform
PO Box 716
N3191 Horten
Norway

● R.V. SOuter
TRS/80 Beeb Users Group
25 Carr Lane
Willerby
Hull HU10 6JP
Tel: 0482 654117

● E.R. Piper
Bognor Computer Group (BUG)
2 Ely Gardens
Aldwick Park
Bognor Regis
Sussex PO21 3RY

● Andrew Pike
Peterborough Personal Computer Club
920 Bourges Boulevard
Peterborough PE1 2AN
Tel: 0733 44342 (after 5pm)

● Dave Clare
Mid-Cheshire Computer Club
'Providence House'
222 Townfields Road
Winsford
Cheshire CW7 4AX
Tel: Winsford 51374

● **Liverpool BBC Microgroup**
c/o Fred Shaw
14 Albany Avenue
Eccleston Park
Prescot
Merseyside L34 2QW

● John Harris
Bottisham Acorn User Group
1 Rowan Close
Bottisham
Cambridge CB5 9BN
Tel: (0223) 811487

● Peter Smith
Fareham and Portchester Amateur Computer Club
23 Sandy Close
Petersfield
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● Paul Barbour
Laserbug
10 Dawley Ride
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Berks. SL3 0QH
Tel: 02812 3064

● Brian Pain
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40a High Street
Stony Stratford
Milton Keynes
Tel: (0908) 564271

● Mr. D. Coulter
Preston BBC User Group
8 Briar Grove
Ingol
Preston PR2 3UR

● **Acorn Users Group of Sweden**
c/o Janne Soderberg
Frihetsvagen 32
S-175 33 Jarfalla
Sweden

● Dilwyn Jones
Bangor & District Micro Users Group (BADMUG)
Fodol Farm
Hafod Lane
Bangor
Gwynedd LL57 4BU

● Peter Wilson
Universal Micro Club
26 North Cape Walk
Corby
Northants NN18 9DQ
Tel: Great Oakley 742622

● John Haigh
Iver Computer Society (IC's)
141 Leas Drive
Iver
Bucks SL0 9RP

●John Eary
Kinder Peek Computer Club
36 Parkway
New Mills
Tel: New Mills 43870

● C. Verrier
Wandsworth Computer Club
Earlsfield Library
Magdalen Road
London SW18

● Mr J. Craig
National BBC User Group
40 Mount Pleasant Avenue
Wells
Somerset BA5 2JQ

● Mr R. Luff
Kingbee
54 Arlington Close
Kingswinford
West Midlands

● **Computer Club**
Caterham Leisure Centre
Godstone Road
Caterham
Surrey CR3 6RE
Tel: Caterham 48304/43316

● Ted Ryan
Eastwood Town Microcomputer Club
15 Queens Square
Eastwood
Nottingham NG16 3BJ

● Mr T.A. Kayani
SOBAT Computer Club (East London)
B25 Berridge House
Hillfield Road
West Hampstead
London NW6

● Mr M.G. Forster
Potbug BBC Users Group
8 St George's Avenue
High Lane
Tunstall
Stoke-on-Trent
Tel: 818499

● **Muse** (for teachers)
Freepost
Bromsgrove
Worcs B62 7BR

● Mr B. Carroll
The Cottage,
42 Manor Road,
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●Steve McLeod
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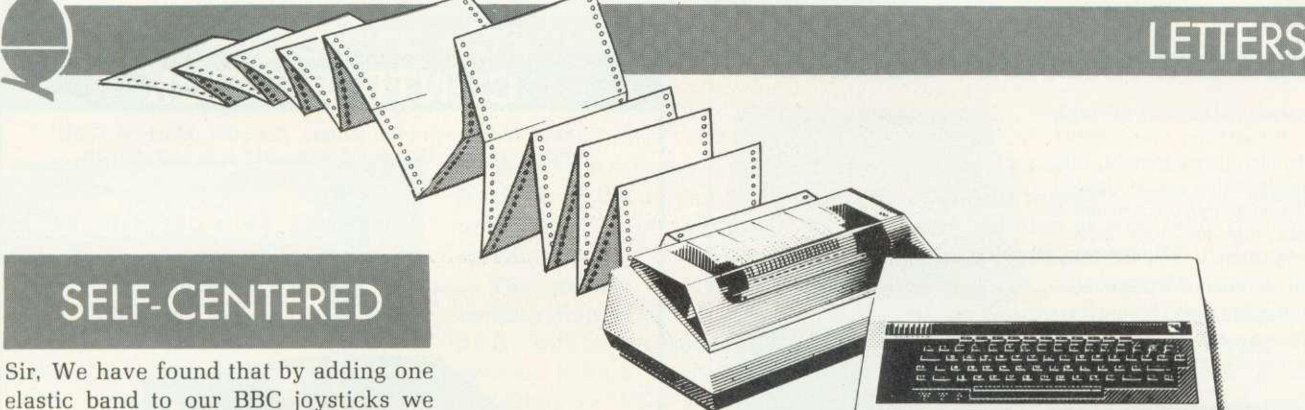
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SELF-CENTERED

Sir, We have found that by adding one elastic band to our BBC joysticks we have made them self-centering.

Place the band round the circlet of plastic and unscrew the joystick and joystick peg. Put the band round the joystick peg from both sides and retighten the screws and replace the peg.

It is simple, effective and helps in many games.

Nic Smith
Reading

SOUND ADVICE

Sir, Having read a lot of letters from readers about improving the sound of BBC micro, I am writing to tell you about the sound module I purchased from a local firm. It is fitted inside the computer and requires no soldering at all. It transfers sound from the computer to the television via the standard modulator fitted in the computer. The volume and quality of sound is then only limited by the television.

I paid just £9.95 (inc VAT) for my sound module from: Kayde Electronic Systems, The Conge, Great Yarmouth, Norfolk.

Hope this helps many of your readers.

N. Fulton
Great Yarmouth

ROUTINE ADVICE

Sir, First of all may I say how I enjoyed John Ferguson and Tony Shaw's article on interrupts (*Acorn User*, June).

In program 7 (page 62) I noticed they had written a routine (.CONV) to output the ACC in hex. I would like to point out that the Basic I ROM contains a routine to do this at location &8570. Also, location &856A will output hex of ACC followed by a space.

A complete map of the Basic ROM, Basic action addresses, page usage etc, can be found in (dare I say it?) *Personal Computer World* (July 1982) in an article entitled 'Anatomy of the BBC Micro'.

Hoping this is of use.

Murray Elliot
Glenrothes

The PCW article is excellent, and we would recommend it to anyone with a Beeb (indeed it has already been referenced).

STEP ON OUT!

Sir, After reading your articles on interrupts, I wondered if you could tell me whether programs that allow you to single-step through machine-code do this by using the 6522 to interrupt the program, or by some other means?

Mike Cheshire
Kent

It is possible to use the 6522 to single-step a machine code program. However, on the BBC micro there are a huge number of interrupts in use at any time, with the result that such a technique is difficult to implement.

Alternatively, the code to be executed may be loaded to a specific place and executed at the desired speed in situ, thus allowing sophisticated control of program flow to be exercised.

COLOURLESS

Sir, I have wondered for a long time if the Electron is colour or not, because I am thinking about buying it, and if it is not colour it will be even more expensive than the Atom, although it has a 32k memory and it can run Beeb games. I am asking this because you have not said anywhere, only reporting that it is a cut down Beeb – but that might not include the colour.

Could you also give me more information on the Electron, including where or if it is on sale overseas.

I would also like to know the price of the various modules and interfaces for the Electron.

Jason Fell
Kent

Allow me to quote from Acorn User, October 1982 on the Electron; 'Eight colours are provided, plus flashing'. The articles in this and August's issue fill in the details.

Acorn are expected to launch the machine overseas, but not yet. No prices have been released for the modules nor a release date – although Acorn are *hoping* for Christmas.

The company is not releasing more information until the *Acorn User* Exhibition.

SOAK IT TO ME

Sir, I own a BBC model B, approximately eight months old. Occasionally (about twice a week) after the machine has been running for about 30 minutes it stops working: ie the humming sound stops and the only key that works is break. By pressing break and typing OLD I can retain the program. My nearest dealer is about 30 miles away and the chances are that fault will not show if I take the machine there.

Could you please give some advice.

W. Evans
Oswestry

Our advice would be to take it to a dealer, or send it to RCS. Make sure you describe the fault in full with a note attached to the micro, and tell them to put it on soak – that is leave it switched on for several hours to test it.

RCS has a new address: Enterprise House, Central Way, North Feltham Trading Estate, Feltham, Middx. Tel: 01-844 1333

LION FEEDING

Sir, Concerning your tip on printer line feeds in the February issue, *FX6 works if the line to be printed has fewer characters than the printer width, otherwise overprinting occurs before the LF is sent.

Like a lot of schools, we bought a RML 380Z with a serial interfaced Microline 80 printer. With BBC micros, the following procedure may be of use to readers:

- disconnect the serial interface and connect the micro to the printer using an ordinary centronics cable (ie use it as a parallel printer: I haven't tried it as a serial.)
- On the printer's PCB, move the S4 shorting plug to side B. This automatically sends a LF with a CR.

Note that *FX6,0 should not be used as LFs now need to be filtered out since they are provided automatically by the second step.

Next a query. *FX3,2 (to send output to the printer only) doesn't work in this set-up. We have OS 1.0. Can you help?

R. Fletcher
Hewett School, Norwich

Your problem can be overcome using *FX6,0 with the command WIDTH 6, which forces the production of a linefeed every 6 character. The Microline should respond to the command WIDTH 79 with *FX6.0. This means you can avoid changing the jumper S4. It will also be better to use the Microline in serial, otherwise you will lose the ability to connect it to the 380Z and use the graphics characters. The connections for a serial interface cable for the Microline are shown in table 1.

Your final query gives me the opportunity to explain the workings of *FX3. Information in the *User Guide* (page 422) is incomplete, and incorrect in some respects. There are four bits which control output behaviour, not three. These are bits 0, 1, 2 and 3.

Bit 0 controls the RS423 as described, ie serial output is enabled if bit 0 is set, and disabled if bit 0 is not set. All odd parameters cause output to appear via the RS423 buffer.

Bit 1 controls the screen. If bit 1 is set (ie 1) the screen is disabled. If not set, output appears on the screen.

The printer is controlled by a combination of bits 1, 2 and 3. If bit 2 is set, no output goes to the printer. If bit 3 is not set, the printer (selected by *FX5) is controlled by a combination of bits 1 and 2. If bit 1 is not set, it may be enabled and disabled by VDU2 and 3. If bit 1 *is* set, it disables the VDU drivers. Thus although the printer theoretically is 'active' (bit 2 not set), the enabling command VDU2 cannot be sent, hence no output.

If bit 3 is set, (ie the parameter is 8 or greater), the printer is selected *and enabled* unless bit 2 is set. VDU1, VDU2 and VDU3 have no effect in this state. Table 2 gives the possibilities.

The interactions with *FX5 and *FX6 are, so far as I can discover, as follows,

First, *FX6 suppresses one character in all printer output if the printer is selected by *FX5,1 or *FX5,2. This means you can only send *all* ASCII values from 0 to 255, using *FX3,0 or *FX3,1 and using VDU1, character. This is essential for graphics dumps with the Epson and Olivetti printers for instance.

Second, with serial printers, there is *no* suppression of any characters if *FX3.oddnumber is used. Thus graphics dumps for serial printers can be written using *FX3,3 and do not need VDU1 to allow total ASCII output.

When experimenting with *FX3, the computer will appear to 'hang up' under two circumstances. First if *FX3,n has disabled the screen. Screen output is recovered by typing *FX3,0 even though there is no visible 'echo' of the command. Second, if a selected buffer becomes full, and there is nowhere for the information to go (eg use *FX3.1 without a serial device connected). The caps lock *and* shift lock LEDs light, and the way out is to press escape or break.

There is another misprint in the *User Guide* on input and output. *FX2,0 enables the keyboard, but disables the RS432.

George Hill

Pins on 25-pin plug	Pins on BBC DIN plug
1. Link together with wire loops, pins 5, 6, 8, and 20	
2. Pin 3 (received data)	Pin B (data out)
3. Pin 11 (SSD)	Pin D (CTS)
4. Pin 2 (transmitted data)	Pin E (RTS)
5. Pin 7 (signal ground)	Pin C (0V)

Table 1. BBC to Microline, serial connections

Table 2. Effects of *FX3,n

Value of n in decimal	Value of n in binary: bit 3	bit 2	bit 1	bit 0	Effect: Printer	screen	RS423	Comments
0	0	0	0	0	✓†	✓	X	†Printer controlled by VDU1, 2, 3 and *FX5 & *FX6
1	0	0	0	1	✓†	✓	✓	
2	0	0	1	0	X	X	X	
3	0	0	1	1	X	X	✓	
4	0	1	0	0	X	✓	X	
5	0	1	0	1	X	✓	✓	
6	0	1	1	0	X	X	X	
7	0	1	1	1	X	X	✓	
8	1	0	0	0	✓*	✓	X	*Printer controlled by *FX5 & *FX6, and automatically enabled
9	1	0	0	1	✓*	✓	✓	
10	1	0	1	0	✓*	X	X	
11	1	0	1	1	✓*	X	✓	
12	1	1	0	0	X	✓	X	
13	1	1	0	1	X	✓	✓	
14	1	1	1	0	X	X	X	
15	1	1	1	1	X	X	✓	



VARIATIONS

Sir, Joe Telford, in his 'Hints and Tips' article in the April issue of your magazine, stated that there were a number of variations of the DFS among readers varying from DFS 0.90 (the earliest system on general release) through DFS 0.97 and 0.9A up to DFS 0.9E which is the latest recorded version (Jan '83).

As my machine, which was delivered in February 1983, was fitted with 0.90, I took this up with Acorn Computers and was advised that 'all the machines that we have produced for sale have had, and in fact still do have, 0.90 DFS . . . other versions . . . have been for internal use or field trial only and have never been on general release'.

I am not sure where Joe Telford got his information from but it would appear from Acorn's reply that he was misinformed.

With reference to the non-availability of the first issue of *Acorn User* this is indeed a pity-particularly as you are now offering a binder to house a 'full set'. Surely, you could print further copies as there must be many readers like myself who missed out on it.

P. Bryce
Wirral

Both Acorn and Joe Telford are correct. The versions Joe quoted have all been produced for special projects or developmental work – and many *Acorn User* readers have access to these.

However, normal production machines such as yours are all fitted with 0.90, the only one known to be compatible with other filing systems.

It is unlikely that we shall reprint the July '82 issue, or the February and April issues. This is because of cost. Early print runs were set at 50,000 and it is uneconomical to produce just a few thousand. The cover price would be too high.

INTELLIGENT COMMUNICATIONS

Sir, When are we going to see an article on intelligent communications terminals with modern facilities like auto-answer, auto-dialling, up-down loading of data and screen to memory and tape. I and one other at least would be very interested.

Can you tell me how to get software handshaking of the RS423? I have been trying in vain to achieve this on my dumb terminal which I use for communicating with another Beeb via BT.

Do this for me and I will forgive you for allowing my friend's *Acorn User* to arrive via his newsagent three days before my subscription copy.

Is this tip of any use? I often get mains spikes and power cuts after typing reams with my digit to suddenly discover I have worn out another finger for nothing. I now type * SPOOL "whatever" and set a tape to record when typing in a programme. Sorry, I don't know if there are any bugs to this, it seems to work OK for me.

R. Gregory
Great Yarmouth

Intelligent communications eh? Well, when are you going to write it? That's my answer.

Next, communicating by B.T. See Acorn User, August, page 14, and see what Forum 80 has to offer. Also June issue, page 53, might help.

On the subject of delivery, magazines are usually despatched on the Friday or Monday before the publication date – the third Thursday of each month. However, it does appear that our distributor is more efficient than the Post Office as many newsagents put copies of the magazine out early.

We like the tip, thanks!

PERSONAL ADS

Atom 12k+12k. BBC upgrade, toolbox, wordpack ROMs floating point, cassette recorder, Amber printer, books, cassettes. £220. Steel, Mayberry Chilbolton, Stockbridge, Hants.

Atom 12k+12k, VIA and printer interface, manual and books, PSU, leads, etc, approx £50 worth of software, including Acornsoft synthesiser, Snooker, etc. Accept £120. Phone Hackwood 5119 after 5.30 pm.

BBC Board for Atom with manual. As new – only six months old. Cash flow problems force sale. £40 ono. Phone (0202) 35504. Ask for Andrew Crossman.

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Monitor, Microvitec 14" colour including leads as used in BBC programmes. Brand new £270. Wordwise word processor also brand new £37. Tel: Daventry 3792.

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Intellivision cartridges, voice synthesis and two talking cartridges £250 ono or exchange for BBC B and £100. Phone Sunderland 42319.

Swap Rocket Raid, Monsters, Snapper, Planetoids, Missile Base, Arcadians and fun games (value £80) for View or Wordwise wordprocessing chips. Phone Harpenden 69152.

FORTH (Acornsoft original) £10. Snapper, Sphinx, Philosopher's Quest £4.50 each (all used and on original cassette). Texas Instruments TI-programmer Hex/octal/decimal calculator £15. Phone: 0234-781730, K. Rutgers, 22 Marriotts Close, Felmersham MK43 7HD.

Acornsoft games – Super Invaders, Rocket Raid, Arcadians, Meteors, Defender, Original Snapper, Starship Command, Painter, Monopoly, Galactic Firebirds. All in mint condition. Will swap or sell. Offers tel: Rossendale 217175.

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Atom 14k RAM, 12k ROM, Connectors, VIA, with Getting Acquainted and Atom Magic books, Asteroids £125. Tel: (0494) 28302.

Seikosha GP 250X programmable graphics printer. Parallel and serial interfaces. 64 user definable characters. 50 CPS only six months old comes with manual and cable for BBC £250. Tel Rhoose 710663. Ask for Mr Panayides.

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Commodore CBM 4032 tape recorder, toolkit, manuals, forty games programmes, excellent condition. £325 ono. Winfield Beverley, Shore Lane, Bishop's Waltham, Hants. Tel Bishop's Waltham 4068.

Atom 12k+12k, Program Power toolbox, FP ROM 6522 VIA chip, PSU manual, books, 20+ programs, all leads, not yet 12 months old. £150 ono Tel (061) 797 5681.

Swap ZX81 with full keyboard, input/output port, plus Mastering Machine Code on Your ZX81 + money for Menta Z80 or Micro-Professor. Will consider other offers or purchase of Menta or Micro-Professor. 021-440 4675.

TRS80 pocket computer, printer case etc. £100 or will split. BBC 'B' with books and software £415 ono. 01-520 2664. Evgs.

Atom 14k RAM BBC Basic 6522 VIA 5V PSU, various software, 2 years old, will separate, £200 ono. Billericay 55895.

Rockwell AIM65 8k monitor plus 12k sockets for Basic, Forth assembler 4k RAM onboard, 20-col printer 20-col display, twin tape recorder, teletype and user 6522. Porting bus extension £165. Bellingan Staines 33500.

TRS80 colour computer 16k, original case and manuals plus Learning Lab, Art Gallery cartridge and Space Race game. Also some magazines £165 ono. phone Stuart Wilke (0783) 671329 (evenings).

Software for BBC (B), Salamander, Dragonrider £3.50, A+F painter £4, ASP Valley £4, interface compiler £15. Bourne End 23544 (Malcolm).

Acornsoft Starship Command cassette as new, complete with original packaging and instructions £7. (0742) 745027.

Acornsoft cassettes for sale. Monsters and Rocket Raid, hardly used, £5 each. J. Asprey, 1 Durham Road, East Finchley, London N2.

Sell or swap, Acornsoft Philosophers Quest, Program Power Chess, IJK 3DMaze. Blythe Bridge (078 18) 8423.

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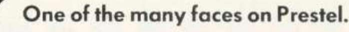
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BACK ISSUES





July/August The first issue. Articles on drawing techniques, the BBC Computer Programme, machine code graphics, questions and answers, hints and tips, sound, interfacing scientific instruments, dumb terminals for 0.1 machines, disc drives, Econet in schools.

September Ceefax telesoftware, Beeb in business, mailing list, simple files, 30-Hour Basic course, art on a micro, music, BBC micro as a keyboard, extra Atom commands, BBC Basic board, ULA design, teletext graphics, machine code graphics, analogue input, schools training, 0.1 cassette bug patch.

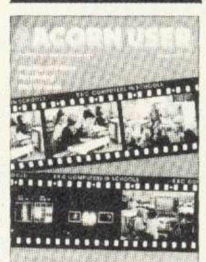
October Electron details, BBC TV series – confessions, two Epson graphics dumps, Seikosha GP100 dump, Worldwide networking for BBC micro, garbage handling, voice ROMs, sound pitch envelope, moving graphics, ZX printer for Atom, RGB colour separations for Atom, biofeedback, book reviews.



November Teletext, second BBC TV series, machine code series 1, programming forum, Trek III, speeding up graphics, Bomber game listing, 7-tone Epson graphics dump, Atom graphics manipulation, dumb terminal for 0.1 machine, firework graphics, editing tips.



December BBC TV in schools, machine code 2 – registers, programming forum, program generators, carols, hints and tips, Logo and turtle graphics in schools, introduction to procedures, software review, Atom word processing, toolbox review, 16-colour graphics on model A, sorting, sound envelope design.



January MEP school launch, *FX commands for sound, second BBC TV series, machine code 3 – two pass assembly, disc drives for the Beeb, programming forum, program protection, micros in schools – new series, Commodore Pet printer used with Beeb, BBC programs written on an Atom, extra Atom memory.

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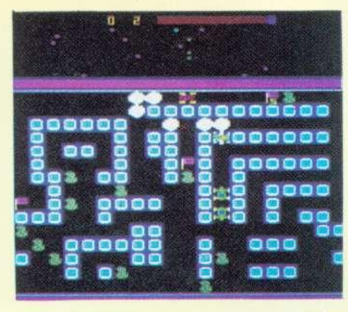
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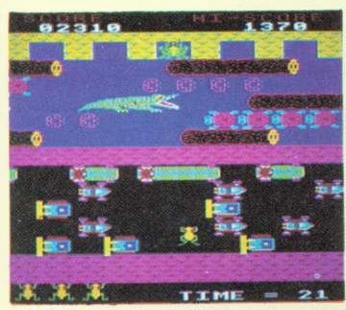
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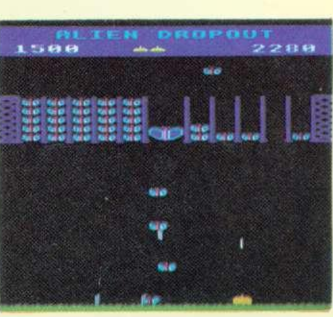
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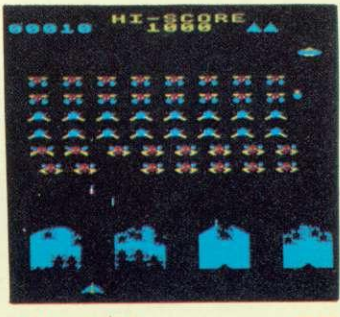
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